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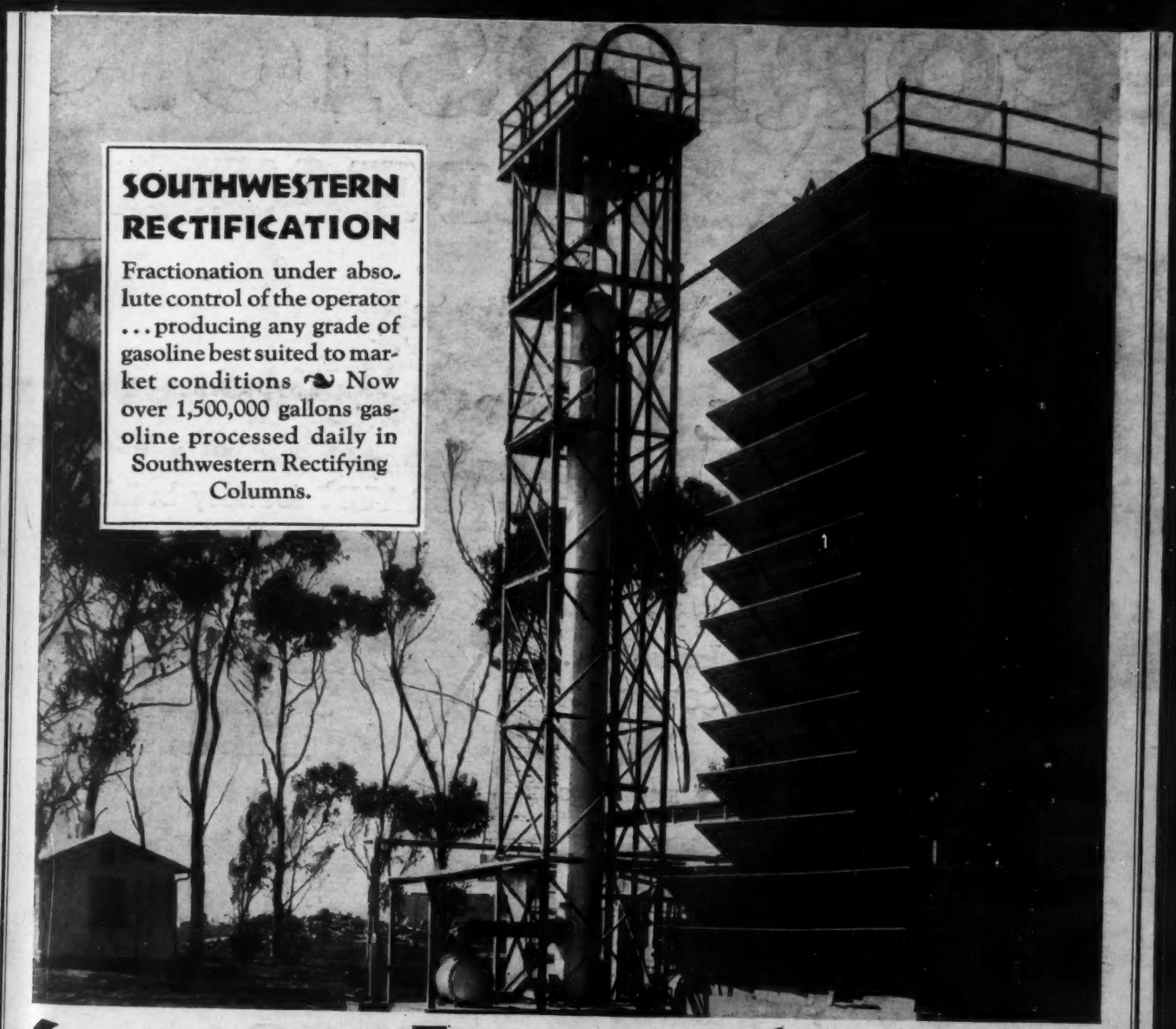

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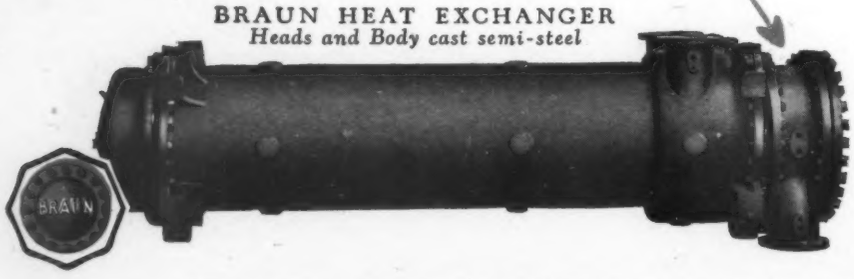

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JUNE, 1929

GRADY TRIPLETT, *Editor*

GEORGE REID, *Associate Editor*

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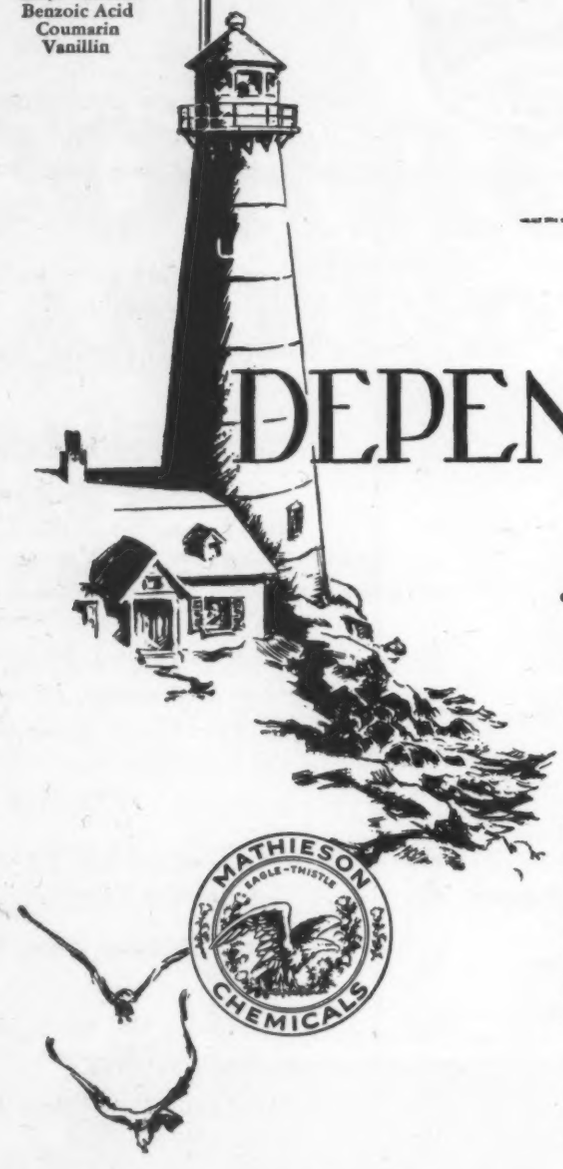

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Secrecy Fades

IT is significant of the change in all business that the refining industry has responded to the program of the American Petroleum Institute, in its effort to assemble operating statistics. Sufficient refining plants of the United States are pledged to assure its success.

While the effect this information may have within the industry may be more vital, still the more pleasant part is the willingness of American executives to submit their plant operations to public scrutiny. The day was not far back when the number of barrels of crude oil to pass through a battery of stills was a secret, guarded like the work of diplomacy.

Plant throughput, however, was guarded no more closely than plant methods. A refinery stood as a monument to secrecy.

The inconsistent part of the whole condition was that men who were striving for secrecy knew the effort was not successful. Executives of one company knew what others were running and what methods were being used in other companies. Withholding information brought little benefit to any company.

At the same time, secrecy bred distrust. One man sought information, expecting incorrect reports to be given him. Distrust came out of a desire for secrecy. So subterfuge often came into the industry. Men realized that certain information should be available. They sought it legitimately and doubted its accuracy. All statements were checked.

Now, however, more than 90 per cent of the petroleum refining capacity of the country has agreed to furnish weekly figures on plant runs to the American Petroleum Institute, through which they will be made public.

This change has come slowly. Common problems helped to bring it. Periods of price depression gave men a sense of their common problems. So confidence came to replace distrust.

What use will be made of the information is a matter of speculation. Reports on plant operation can be used to advantage. If ignored, they will accomplish nothing.

One paragraph of warning may not be out of place. The mere publication of refinery throughout will not accomplish anything. Neither does existence of such statistics convert the problem of profit from an individual one to a collective one. It remains incumbent on each refining concern to so conduct its business that there will be profit from the activity.

Grady Gilbert

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THE Cooper Type 16 is a 50 horse power airless injection Diesel oil engine especially designed for direct driving air and gas compressors. By changing the piston and liner and replacing the fuel pump with a magneto it can be converted to a gas engine in the field It can be furnished with either single or two stage compressors and is being used for pressures as high as 2000 pounds. With certain safety devices added it can be operated without constant attention. Timken roller main bearings, special heat resisting valves, numerous drop forgings and special alloy steel parts make its upkeep unusually low. Write the nearest Cooper branch office for complete information.

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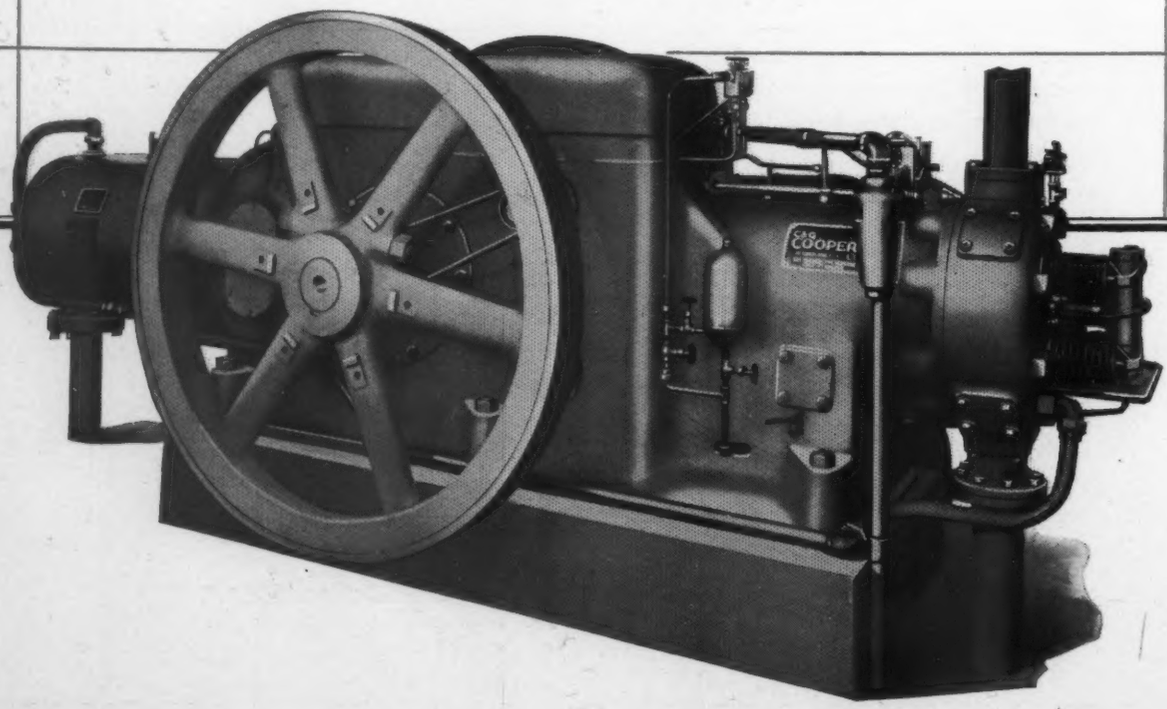


Refinery Operations Only Slightly Above Normal

By H. J. STRUTH
Staff Economist

REFINERS will probably be interested in the timely data presented by Mr. Struth. The fact that his estimates in the past have proven extremely accurate, and his estimates of gasoline demand for the first four months of this year are only slightly below actual results, lends confidence to the reliability of his estimates on normal crude runs by major refining districts. Since the American Petroleum Institute has definitely decided to furnish the refining industry with a weekly report of crude runs, this data will prove of added value as a guide to monthly operations over the rest of this year.

THERE has been a lot of discussion lately concerning the uneconomic refinery practice of running excessive amounts of crude through stills. The concensus of opinion has favored the belief that United States refineries are running crude greatly in excess of normal requirements. This has led the writer to conduct a careful survey of actual conditions, in an effort to determine the present status of refinery operations and obtain some idea of what constitutes normalcy as far as crude still runs are concerned. According to the facts obtained and presented herein, refinery operations in the United States during the first four months of 1929 are practically on a normal basis. On the whole, runs to stills are only seven million barrels in excess of normal, cumulatively, for the four months ending April 30, 1929. Practically all of this excess can be attributed to Texas and California, where crude runs have exceeded normal requirements based upon the actual and potential demand for gasoline. Furthermore, the facts presented here reveal that it will be necessary for refiners to increase crude still runs during June, July and August to a point where the normal peak will aggregate more than 90 million barrels throughput.

Last year, the refining industry processed 910 million barrels of crude. This year, 995 million barrels of crude will be required to adequately meet the demand for gasoline. On the basis of potential gasoline demand, considering necessary storage requirements against future demand, the writer has determined the normal quantity of crude required each month throughout the present year, to be used as a guide to normal refinery operations. This data shows that for the first four months of 1929 the normal throughput required aggregated 305 million barrels. According to the monthly report of the United States Bureau of Mines, refineries actually ran 312 million barrels of crude through stills, or an excess of about seven million barrels over the four month period. On a monthly basis, these facts show that runs were in excess of normal during January and March, while during February and April actual runs were at the approximate normal level. This is illustrated in the accompanying chart, Figure 1, showing the normal course of crude still runs throughout 1929, compared with actual results for the first four months of this year. Table 1 shows the figures upon which the chart was based.

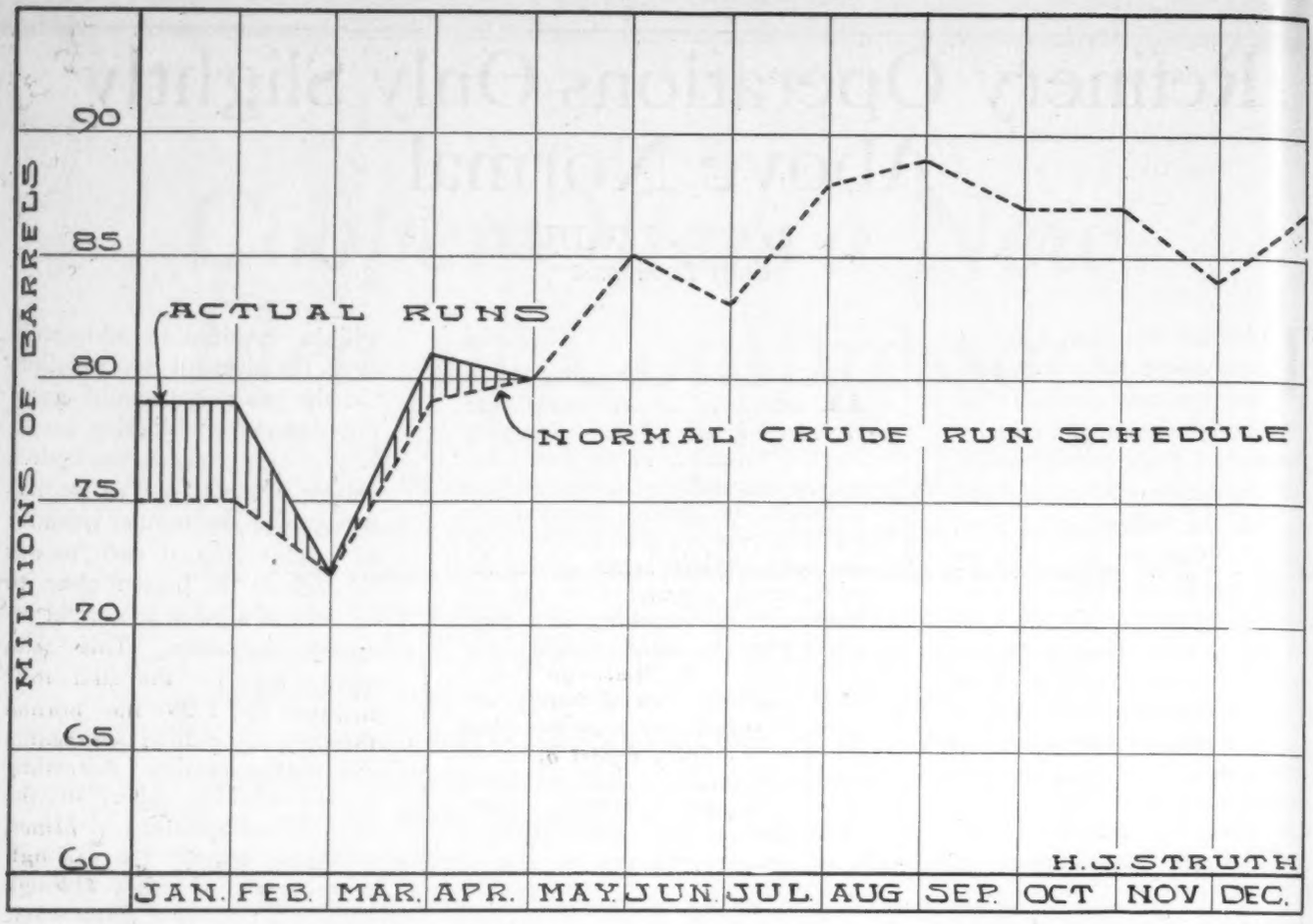
In February the writer presented a forecast of the 1929 gasoline demand, pointing out that the refinery demand for crude would aggregate 995 million barrels this year. In the April issue of *The* REFINER *and* NATURAL

TABLE 1.
Crude Runs Schedule—1929
(Thousands of Barrels)

	Normal	Actual
January	74,546	78,825
February	71,712	72,031
March	78,843	80,708
April	79,778	80,459
May	84,513	
June	82,731	
July	88,218	
August	89,182	
September	87,245	
October	87,019	
November	84,283	
December	86,928	
Total	995,000	

TABLE 2.
Total Gasoline Demand, 1929
Including Domestic and Foreign Demand
(Millions of Gallons)

	—Estimate—		—Actual—	
	Month	Cumulative	Month	Cumulative
January	1,148	1,148	1,145	1,145
February	1,134	2,282	1,157	2,302
March	1,380	3,662	1,398	3,700
April	1,440	5,102	1,458	5,158
May	1,765	6,867		
June	1,713	8,580		
July	1,780	10,360		
August	1,773	12,133		
September	1,712	13,845		
October	1,543	15,388		
November	1,533	16,921		
December	1,475	18,396		



United States refinery crude run schedule year 1929, shows normal course of still runs based upon potential gasoline demand, compared with actual runs to stills

GASOLINE MANUFACTURER, this forecast was detailed, showing the probable monthly gasoline demand on a cumulative basis. With the receipt of the Bureau of Mines report for April, it was found that the actual cumulative gasoline demand for the first four months of this year aggregated 5,158,000,000 gallons, compared with the estimate of 5,102,000,000 gallons. These facts show that the estimate can be relied upon as a guide to this year's monthly gasoline demand as well as a basis upon which to project normal still run schedules. Table 2 contains the monthly estimates of gasoline demand for 1929, compared with actual Bureau of Mines data for the first four months of this year.

Further analysis of normal crude requirements by major refining districts discloses additional valuable information that can be used as a guide to future operations in the respective areas. The results of this study are graphically shown in Figure 2, indicating that Texas and California are chiefly responsible for running excessive amounts of crude to stills. As a matter of fact, it is shown that the total excess for the first four months of 1929 aggregated about seven million barrels, 3,057,000 of which was credited to California and 3,612,000 to Texas. The excesses indulged in by Appalachian, Indiana-Illinois, and Louisiana-Arkansas, were offset by East Coast, Oklahoma-Kansas and Rocky Mountain re-

TABLE 4

MONTHLY CRUDE STILL RUN SCHEDULE—MAJOR REFINING DISTRICTS

YEAR 1929

(THOUSANDS OF BARRELS)

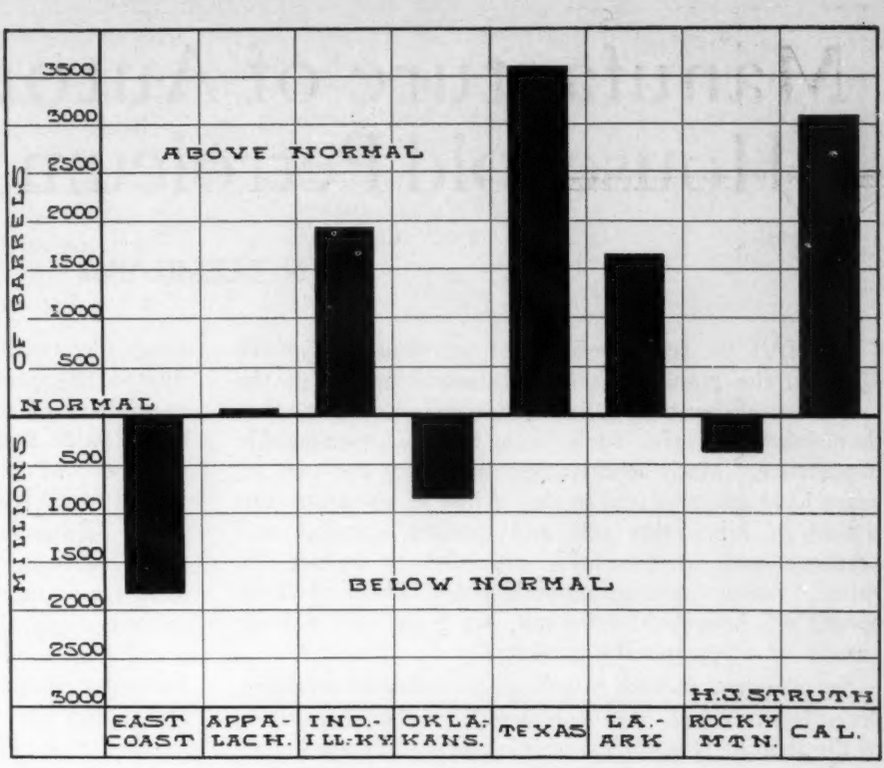
	East Coast		Appalachian		Indiana-Illinois		Oklahoma-Kansas	
	Normal	Actual	Normal	Actual	Normal	Actual	Normal	Actual
January .	13,847	14,045	2,628	2,878	7,736	8,611	9,067	9,136
Febraury .	13,093	12,778	2,588	2,417	7,342	7,754	8,665	8,101
March . . .	14,479	13,913	2,835	2,767	8,428	8,504	9,470	9,298
April	14,918	13,778	2,890	2,918	8,185	8,733	9,707	9,539
May	15,858	. . . .	3,090	. . . .	9,210	. . . .	10,474	. . . .
June	16,121	. . . .	3,154	. . . .	9,331	. . . .	10,028	. . . .
July	16,952	. . . .	3,277	. . . .	9,654	. . . .	10,701	. . . .
August . .	16,403	. . . .	3,332	. . . .	10,066	. . . .	11,291	. . . .
September	16,031	. . . .	3,357	. . . .	9,850	. . . .	10,952	. . . .
October .	15,669	. . . .	3,273	. . . .	9,581	. . . .	10,914	. . . .
November	14,786	. . . .	3,106	. . . .	9,436	. . . .	10,045	. . . .
December	15,518	. . . .	3,203	. . . .	9,294	. . . .	10,242	. . . .
TOTAL	183,682	. . . .	36,778	. . . .	108,122	. . . .	121,558	. . . .

fining districts. The facts indicate therefore that Texas and California must reduce still runs to the extent of nearly seven million barrels during the next few months in order to maintain equilibrium. Table 3 serves to emphasize the status of the various major refining districts.

Refiners in the various major refining districts will probably be interested to obtain detailed information showing the normal monthly crude run requirements for the balance of this year in the respective areas. The fact that the American Petroleum Institute will shortly supply weekly reports showing actual still runs by districts, as well as data covering gasoline production and stocks, indicates the value of having a fairly reliable guide to determine the exact status of any refining district throughout the balance of this year. With this idea in mind, the writer has prepared a detailed analysis o feach major refining district, showing the normal crude throughput required, together with actual Bureau of Mines reported runs for the first four months. Table 4 presents complete data for each district, arranged in convenient form to permit readers to use it as a handy record.

Gasoline demand continues at an unusually high rate, exceeding even the most optimistic estimates. Apparently, the early optimism expressed by automobile manufacturers was justified, as reports indicate that automobile sales are topping all previous records. This spells a big gasoline demand for 1929, which may even exceed the estimate given herein of 18,396,000,000 gallons.

Now, more than ever, it is up to the refiner to maintain control over his supply situation. Increased runs are justified in the light of the data presented herein, but excessive runs must be avoided if present prices are to be maintained.



Operating status of major refining districts first four months of 1929 shows how actual cumulative crude runs to stills compare with normal quantity required to produce gasoline demand

TABLE 3

Crude Still Runs—first four months of 1929
(Thousands of Barrels)

	Indicated Normal	Actual	Excess
East Coast	56,337	54,514	**1,823**[1]
Appalachian . ..	10,941	10,980	39
Indiana-Illinois .	31,691	33,602	1,911
Oklahoma-Kansas	36,909	36,074	**835**[1]
Texas	63,421	67,033	3,612
Louisiana-Ark. ..	24,507	26,115	1,608
Rocky Mountain.	8,574	8,369	**385**[1]
California	72,279	75,336	3,057
Total U. S. ...	304,879	312,023	7,144

[1]—Bold figures indicate below normal.

TABLE 4

MONTHLY CRUDE STILL RUN SCHEDULE—MAJOR REFINING DISTRICTS

YEAR 1929
(THOUSANDS OF BARRELS)

Texas		Louisiana-Arkansas		Rocky Mountain		California		United States	
Normal	Actual	Normal	Actual	Normal	Actual	Normal	Actual	Normal	Actual
15,410	16,205	6,056	6,544	2,162	2,134	17,596	19,272	74,546	78,825
15,050	15,868	5,671	6,136	2,016	1,881	17,289	17,096	71,712	72,031
16,284	17,524	6,207	6,900	2,237	2,173	18,905	19,629	78,843	80,708
16,677	17,436	6,573	6,535	2,339	2,181	18,489	19,339	79,778	80,459
17,198	....	7,435	....	2,590	....	18,660	....	84,513	....
15,872	....	6,606	....	2,383	....	19,120	....	82,731	....
10,018	....	6,675	....	2,530	....	20,412	....	88,218	....
18,414	....	7,081	....	2,531	....	20,066	....	89,182	....
17,153	....	7,630	....	2,491	....	19,780	....	87,245	....
17,537	....	7,836	....	2,495	....	19,716	....	87,019	....
17,834	....	7,356	....	2,369	....	19,358	....	84,283	....
17,937	....	7,452	....	2,354	....	20,929	....	86,928	....
203,384	....	82,580	....	28,490	....	230,399	....	995,000	....

Manufacture of Automotive and Household Petroleum Specialties

E. N. KLEMGARD

THAT the larger refiners of petroleum are awake to the possibilities of substantial profits in the manufacture and distribution of specialties other than lubricants and fuels is a fact of considerable importance. Many manufacturers, during the past 10 years have come to realize that a line of products consisting of lubricating oils and greases, gasoline and kerosene may be profitably extended to include fly spray, furniture and automobile polish, cleaning fluid, spring oil, household lubricant, spray oil and a large variety of other specalty products.

Some companes wish to enlarge their line of products. Negotiations have been completed for the acquisition of the firm of Daggett & Ramsdell of New York, manufacturers of cosmetics and toilet articles by the Standard Oil Company of New Jersey's specialties subsidiary, Stanco, Inc. Other companies making a complete line of automotive and household products are the Gulf Oil Corporation, Shell Company, and The Texas Company.

That the interest in specialties is very keen is apparent from the amount of time, energy and money devoted to the study of such products by the larger refiners. In some cases it has been necessary to increase the personnel of the chemical research staffs in order to make analyses and routine tests of competitive goods as well as the products developed. It is obvious that in the development of a single new product that a great amount of painstaking work must be done in collecting a large number of competitive products in the open market, making chemical analyses of same and determining the relative merits of each from a practical standpoint. Following this must come a survey of other possible compounds and materials which may offer some particular utility. Accurate methods of determining the value of the products must be developed and applied to the experimental batches.

DESIRE FOR NEW PRODUCTS

It is often noticed that the sales organizations of those refiners, who do not produce specialties, frequently submit samples of new lines of products made by competitors to the refinery laboratory for investigation with a view to the development of a similar product. Requests of such a nature throw a considerable burden on the chemist as the accurate analysis of the complex organic mixtures requires a special technique and is often very difficult. It is the writer's object to present results of his investigations along the lines just mentioned, as such material is not always available in the literature and is often valuable in the development of satisfactory petroleum products in the least possible time. The smaller refiner often takes the attitude that due to the expense involved in the development of specialties of satisfactory quality it is better not to bother with them. The formula given here are suggestive and with proper modifications should be readily used by any refiner.

The equipment required is usually of the simplest type, consisting of mixing vats and the regular equipment for transferring the materials and measuring their quantity. Specialty manufacturing does not generally entail heavy initial expenditures for additional manufacturing equipment. Containers are an important item and if they are of sufficiently attractive design to appeal to the trade are expensive. In general the cost of materials used for compounding are quite low when compared to the selling price of the finished article. In cases where the refiner has an established brand well known to the public, the sale of specialties under this name has many advantages, and a considerable volume may be readily built up. Where the marketing organization operates a chain of service stations the specialties may he handled through them with very little additional sales expense.

AUTOMOBILE POLISH

The polishes sold on the open market in this country may be roughly classified as to their form and composition as follows:

I. LIQUID POLISH

a. Oil
b. Oil and water emulsified with various soaps.
c. Oil and water mixtures containing mineral abrasives.
d. Oil and water mixtures containing mineral abrasives and weak organic acids.
e. Oil and water mixtures containing mineral abrasives and waxes (Non-accumulative wax polish).
f. Oil and wax mixtures (Liquid-wax).

II. PASTE OR SEMI-SOLID POLISH

a. Oil and waxes.
b. Oil, mineral abrasive and wax.
c. Oil, mineral abrasive, soap and wax.
d. Oil, mineral abrasive and soap.
e. Any of the above with the addition of weak organic acids.

The following chemical analysis have been made on a large number of the most important polishes marketed in this country. Many of them are nationally known

and have been sold for many years. It is possible that in making a large number of analyses of this kind that small quantities of organic material have been overlooked, also it was found that samples purchased at various times indicated considerable variations in the amounts of the various constituents present. For these reasons the samples will be referred to by number rather than by name. It will be noted that almost all of the polishes analyzed may be listed under one of the types given above.

No. 1 AUTO POLISH

	Per Cent.
Free Castor Oil	.47
Combined Castor Oil	3.01
Combined Caustic Soda	.43
Free Fatty Acids	1.36
Water	42.12
Mineral Oil, Pale	52.61
(Viscosity @ 100° F.; 86)	

No. 2 AUTO CLEANER

	Per Cent.
Very fine, air floated Silica	4.35
Water	58.39
Albumen	7.03
Turpentine	30.23
Oil Mirbane (Nitro-benzol)	Trace

No. 2A AUTO POLISH
(Same make as No. 2)

	Per Cent.
Carnauba and Other Waxes	20.00
Petroleum Distillate	80.00
(43° Be. Gravity.)	
Green Dye	Trace
Oil Mirbane	Trace

No. 3 OIL POLISH

	Per Cent.
Fir Seed Oil	5.50
Orange Dye	Trace
Kerosene	6.00
Light Mineral Oil	88.50
Gravity 34.4° Be.	
Flash 190° F.	
Vis. @ 100° F. 43.	
Pour 20° F.	
Solid 15° F.	

No. 4 AUTO BODY POLISH

	Per Cent.
Water	63.58
Acetic Acid	2.24
Kieselguhr	6.98
Light Mineral Oil	27.20
(Vis. @ 100° F.; 50)	

No. 5 AUTO BODY POLISH

	Per Cent.
Mineral Oil	98.84
Paraffin Wax	1.16
Sassafras Oil	Trace
Red Dye	Trace
Gravity 29.5° Be.	
Flash 305°.	
Viscosity @ 100° F.; 64.	
Pour 40° F.	

No. 6 POLISH

	Per Cent.
Water	63.53
Mineral Seal Oil	21.00
Paraffin Wax	3.70
Talc	4.14
Sodium Bicarbonate	7.63
Oil Wintergreen	Trace

No. 7 AUTO POLISH

	Per Cent.
Lactic Acid	1.43
Silica	1.90
Water	46.47
Lubricating Oil	44.59
(Viscosity @ 100° F., 103)	
Fatty Oil	4.16
Antimony Chloride	1.45

No. 8 AUTO POLISH

	Per Cent.
Water	80.61
Mineral Oil	14.44
(Viscosity @ 100°, 55)	
Kieselguhr	3.70
Oxalic Acid	1.25
Oil Sassafras	Trace

No. 9 CLEANER

	Per Cent.
Water	18.58
Mineral Oil	30.00
Soap	2.00
Paraffine Wax	2.63
Fine Silica	46.79

No. 9A AUTO POLISH

	Per Cent.
Carnauba and other waxes	30.00
Petroleum Distillate	70.00
Gravity 45.8° Be.	
Initial B.P. 310° F.	
Final B.P. 460° F.	
Green Dye	Trace
Oil Mirbane	Trace

No. 10 POLISH

	Per Cent.
Water	70.00
Emulsifying cutting oil	30.00

No. 12 POLISH

	Per Cent.
Water	59.97
Petroleum Distillate	10.84
Fine Silica	24.75
Iron Calcium and Magnesium	1.99
Soda Soap	2.05

No. 13 OIL POLISH

	Per Cent.
Medium Lubricating Oil	20.00
Raw Linseed Oil	10.00
Boiled Linseed Oil	5.00
Mineral Seal Oil	65.00

No. 14 POLISH

	Per Cent.
Boiled Linseed Oil	2.00
Medium Lubricating Oil	8.00
Gasoline	90.00

No. 15 AUTOMOBILE POLISH

	Per Cent.
Water	58.23
Fine Silica	7.19
Mineral Oil (Gravity 34° Be.)	26.00
Oil of Citronella	Trace
Hydrochloric Acid	8.58

No. 16 POLISH

	Per Cent.
Water	64.00
Sulfuric Acid	1.81
Fine Silica	9.23
Mineral Oil (Gravity 34° Be.)	22.96
Oil of Citronella	2.00

No. 17 POLISH

	Per Cent.
Water	61.52
Petroleum Distillate Gravity 46.6° Be.	31.70
Free Caustic Soda	.20
Soda Soap	3.09
Fine Silica	2.73
Paraffine Wax	.73

TABLE I.
RESULTS OF PANNEL TEST ON VARIOUS POLISHES

NUMBER OF POLISH	Condition of Panel After Exposure For: ONE MONTH	TWO MONTHS	THREE MONTHS	FOUR MONTHS
1	Poor—Oil gummy film	Poor. Dull spotted areas	Poor. Same.	Very Poor. Very dull all over entire surface.
2	Good Faint oily film.	Good Same.	Fair. Dull spots.	Fair. Dull spots.
3	Very poor dull and spotted.	Very poor. Dull.	Very poor. Dull.	Very Poor. Very dull over entire surface.
4	Good, some abrasion high luster.	Good. High luster.	Fair.	Poor luster.
5	Poor. Oily film.	Poor. Dull and spotted.	Very poor. Dull and spotted.	Very poor. Dull over entire surface.
6	Good. High luster, no oil film.	Good.	Good.	Good. A few dull spots.
7	Fair. Faint oily film.	Fair. Same.	Fair. Dull Spots.	Poor. Dull spots.
8	Good high luster.	Good. Same.	Fair. Dull spots.	Fair. Dull spots.
9	Good. High luster.	Good. Same.	Good. Uniform high luster.	Good. High luster.
10	Fair. No oily film.	Fair. Dull patches.	Fair. Dull spots.	Fair. Dull spots.
11	Poor. Spotted.	Same.	Same.	Poor. Very dull.
13	Poor. Dull suots	Very poor. Dull spots.	Very poor. Entirely dull.	Very poor. Entire surface very dull.
14	Poor.	Poor. Dull in spots.	Poor. Entirely dull.	Poor. Very dull over entire surface.

Observations have indicated that a polish of the type of No. 13 containing a large proportion of mineral oil which is non-drying and also a drying oil such as linseed oil are objectionable as auto polishes. The non-drying oil has a tendency to collect dust. When using polishes of this type on enameled surfaces a thin oil film remains which is very difficult to remove by rubbing. On continued use of products of this kind the film of oil becomes thicker and furthermore some of the oil as such or in a partially oxidized condition, appears to be absorbed at the surface of the enamel with consequent dimming of the original lustre of the finish.

In testing the various polishes 24 inch by 18 inch sheet steel plates were made use of. Some of these panels were given three coats of baked enamel and others finished with lacquer as automobiles are now commonly finished. The panels thus painted were exposed to the weather on a rack for one week, after which they were washed with tap water, no soap being used. After drying, the polishes were applied exactly as directed by their respective manufacturers. One panel was used for each polish. The surfaces were then inspected carefully and compared with each other. The exposed panels were polished once each week for a period of four months. The results obtained with the enameled panels are shown in Table I.

RESULTS WITH ENAMELED PANELS

It was found that those polishes consisting almost entirely of mineral oil were first to cause dulling of the finish of the test panels, for most of these the finish being more dull after one month than the blank panel on which no polish had been used. The mineral oil and water emulsions left much less oil on the surface than the straight oil polishes. The oil and water emulsions containing mild abrasives is intended as a combined cleaner and polish and while at frst it appears to give better results it does not add much to the life of the finish. However polishes of this type are easily applied and do not leave much oil on the finish. The effect of the organic acids and dilute mineral acids is to assist in the solvent action of the mineral oil in dissolving grease and gums.

Emulsions of oil and water to which various waxes have been added are known as non-cumulative wax polishes. When applied in very thin layers the polish dries rapidly leaving a thin friable film which rubs off readily. A dry surface is left which does not attract dust. This type of polish however is not very effective on old, dead or checked finishes, and has the further disadvantage that it leaves abrasive with the thin film of wax which remains, and if too much is applied becomes sticky and gummy.

The most effective polish was found to be the wax polish in paste form. In using this polish a film of very hard wax (carnauba wax) is left on the surface which takes a very high polish and is very effective in protecting the finish against deteriofaton. A newly finished surface polished with the wax is protected from scratches, road dust, and the weather. After the wax polish has been used two or three times it is necessary to make use of an abrasive cleaner to remove the wax film which builds up. This may be done however with out apparent damage to the original finish. The chief disadvantage of this kind of polish is the additional labor required in going over the surface twice, once with cleaner and once with polish.

RESULTS ON LACQUER FINISHES

Similar tests on lacquered finishes have indicated that oil and water polishes containing very fine mineral

abrasives and a dilute acid are to be preferred. It is of course obvious that the action of such a polish is that of a cleaner rather than the idea of the wax polish which is that of building up a thin layer of protective material. In general the dilute acids useds have no harmful effect on the lacquered surfaces and it is usually conceded that upon the choice of the acid employed depends that quality of the polish which causes it to be easily and quickly removed and also leaving a minimum of oily film and grease on the surface.

FORMULA FOR WAX POLISH

Per cent. By Wt.	Material	Cost per lb. of Material	Cost per lb. of Polish
26.000	Yellow Beeswax	$0.40	$0.0480
8.000	No. 2 Carnauba Wax	.40	.0320
8.000	160 m.p. Ceresin Wax..... (Yellow)	.15	.0120
71.725	300 to 400 cut Petroleum Naphtha	.03	.0215
.250	Oil of Mirbane	.11	.0003
.025	Oil Soluble Green Dye (Foster-Heaton No. 402)		
	Total Cost of Materials for One Pound of Polish.....		$0.1138

It appears evident from these cost figures that there is sufficient spread between cost of materials and the usual selling price of 50 cents to $1 per pound, to warrant satisfactory profits. The manufacturing process is very simple and inexpensive. The waxes and a part of the naphtha are heated together in a mall steam jacketed iron kettle until the waxes are completely dissolved, and the balance of the naphtha added while the material is kept in a melted condition. The odor and dye are added after cooling to a temperature just above that at which some of the wax begins to crystallize. The mixture is drawn into shallow, tin containers to a depth of about three quarters of an inch. Considerable care must be taken to carefully regulate temperatures and maintain a cooling rate which will produce a wax cake of satisfactory texture.

An abrasive cleaner is generally recommended for use in conjunction with the wax polish. The following formula is suggested.

15.00 % Water
25.00 % Petroleum Naptha (Turpentine Substitute)
3.00 % Paraffine Wax
1.50 % Laundry Soap
55.50 % 300 Mesh Rose Tripoli

This product is most satisfactorily made by dissolving the soap in warm water and mixing the solution with the powdered silica and stirring until a uniform product is obtained. The naphtha in which the wax has been dissolved is then mixed in while stirring. The wax polish as described above may also be used for polishing linoleum and hardwood floors.

FORMULA FOR LACQUER POLISH AND CLEANER

A very successful combined polish and cleanser for lacquered automobile finishes is made from the following substances.

Per Cent. By Wt.	Material	Cost per lb. of Material	Cost per lb. of Polish
26.00	Pale Neutral Oil 50 Viscosity @ 100°F.....	$0.010	$0.0026
4.00	44 p.c. Light Refined Lactic Acid	.120	.0048
.50	98%Sulfuric Acid	.070	.0004
62.00	Water	...	....
7.00	Very Fine Filter Cell (Diatomaceous Earth) ...	.020	.0014
.40	Oil of Mirbane.....	.110	.0005
.10	Oil Soluble Red Dye	...	....
	Approximate Total Cost of Materials for One Lb. Polish....		$0.0097

It would appear that there is a remarkable opportunity for profit in the manufacture and sale of a polish of this type. A lead lined tank, equipped with compressed air agitation or motor driven propellar type agitation, may be used to advantage in compounding the above materials. It is preferred to market this liquid polish in colored glass bottles. It is important that the diatomaceous earth be of very fine grade as course particles may in some cases cause scratching of varnished surfaces.

Per Cent.	
48.00	White Medicinal Oil Saybolt Viscosity @ 100° F; 75 A. P. I. Gravity; 30.5 Flash; 300° F. Cold Test; -5° F. Color; Plus 25
40.00	Special Naphtha; Initial B. P. 300° F. Final B. P. 400° F.
6.50	44 p.c. Light Refined Lactic Acid
5.21	Water
.26	Oil of Citronella
.03	Dye; Sudan Orange I

CLEANING FLUID

While many refiners are doing a considerable business in special refined oils and cleaners naphthas a few have found it desirable and profitable to make and sell direct to the consumer a household cleaning fluid. These liquid cleaners or dry cleaners are used as solvents to take up grease stains and gums. It of course must be harmless to the fabrics being cleaned.

Furthermore it should dry quickly and be free from fire hazard. It is believed that a cleaning fluid which fulfills the requirements mentioned may be made on the following specifications.

Per Cent. By Volume	Material
60.00	Petroleum Naphtha Initial B. P.; 260° F. Final B. P.; 360° F.
40.00	Carbon Tetrachloride

Fly sprays are very popular and the volume of them being distributed by certain refiners is considerable. There is a wide margin of profit in the sprays as they are easily and cheaply made and sell for a rather high price. They are usually marketed in pint, quart, one and five gallon cans, together with small pump type hand sprayer. For large users the spray oil may be safely marketed in the usual 30 and 55 gallon barrels.

FORMULA FOR FLY SPRAY

Per Cent. By Volume	
98.6	Kerosene Flash (Closed), not less than 115° F. Sulfur .01 to .03 per cent. A. P. I. Gravity 40 to 41 Initial B.P. 300 to 305° F.
7.	Artificial Oil of Sassafras
.7	Oil of Wintergreen
	Extract from 0.6 pounds of Insect Flowers per gallon of spray oil.

The insect flowers referred to are the pyrethrum

(Continued on page 82)

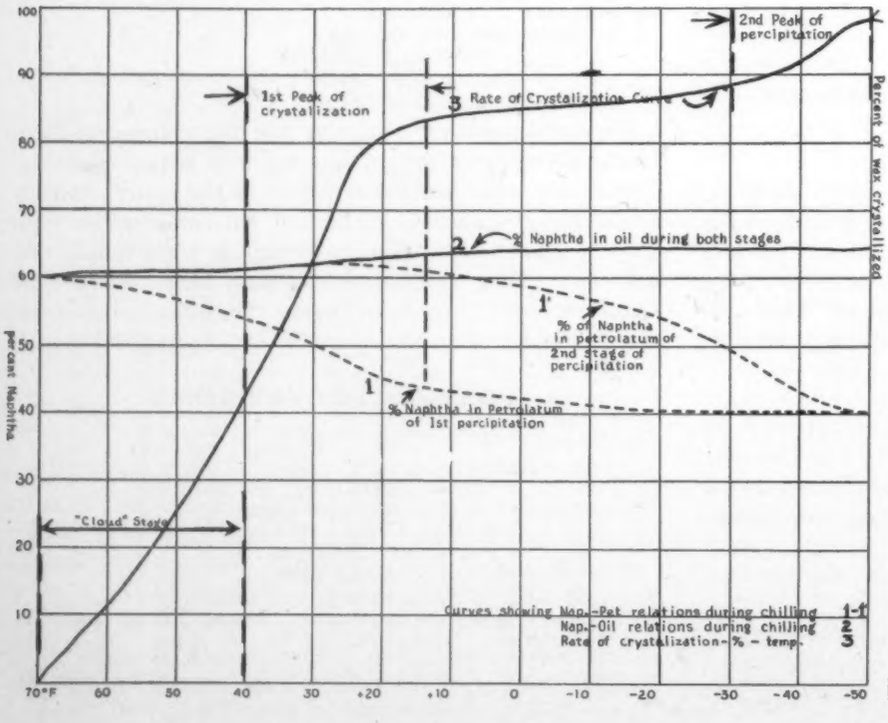
Handling Vacuum Distilled Wax-bearing Products

By EARL PETTY
Smith Engineering Company

BY THE latest vacuum distillation method there is only one side drawn stream and one overhead stream. These two products have the entire rectifying and stripping effect of the entire column. The tower is so fitted and of such a size that its action and results are not to be compared with that of multiple side stream towers. Wax distillate is not a side drawn product, but an overhead product which gives the highest quality fractionation possible. The side drawn material is prepared under proper vapor velocity conditions over from five to seven plates. This section is separated from the bottoms stripping section by a receiving section into which the heated oil is discharged from the still. From this receiving section, the vaporized products pass up into the major part of the tower, and the heavy asphaltic liquid materials pass down into the stripping section where any light entrained vapors will be recovered and carried into the upper part of the column by a limited amount of stream. The bottom section does not carry a large quantity of bottoms, but consists mainly of stripping plates and just enough liquid capacity to serve as a seal and balance against the pumping out system. This prevents cracking of the coloring matter due to time factor, which might take place even with the reduced temperature and pressure which exists.

With this equipment can be prepared a directly pressable wax distillate of any viscosity that can be commercially and economically pressed. There is no side drawn slop fraction to be re-distilled. If the viscosity of this material is too high for economical pressing, it may be diluted with gas oil or kerosene and pressed without re-distillation. This wax distillate cannot be compared with a side drawn wax distillate in color or pressing qualities as it is absolutely free from inhibiting materials which are carried in poorly fractionated and distilled wax distillates where even a small percentage of high boiling materials may entirely upset the pressing characteristics.

In connection with the side drawn stream, it receives the strippings by reflux from the overhead product so that its initial boiling point is very closely regulated and there are enough plates in this service to give a closely fractionated product, passing all coloring material of high boiling range into the base of the tower. In this product is obtained a maximum viscosity with high flash and fire test and maximum grade color. Materials prepared by this equipment have from 30 to 50 degrees higher flash and fire for a given viscosity when compared with residue stock from the same crude. The pipe still outlet temperature and the reduced pressure carried on the tower are so regulated so that there will be no cracking effect on the coloring or pitch material that is to be residued. This temperature varies between 715 degrees and 790 degrees F. depending on the characteristics of the crude.



FREE OF ASPHALT

The side drawn product carries a balance between coloring matter and wax in such a form that all the wax is free to be precipitated by normal temperature effects, and is indicated by the high cold test of this product, ranging between 75° to 100° F. (depending on crude origin). With the freedom of excess coloring matter, which would result in partial dissolving of waxes, a stock is secured which can be diluted and chilled in the conventional manner and de-

waxed with centrifugal equipment without further treatment or filtration.

This is due to the fact that this carefully fractionated material carries no high boiling range coloring matter or asphalt, (or coloring matter which by cracking has been re-arranged into lower boiling range) which materials have a colloidal-solvent effect on waxes, making it impossible to precipitate and remove the wax until these are first removed. In other words, in order to produce a material that can be dewaxed with centrifuges it is necessary to have a product that has been stripped of the light-end materials from the top that tend to accelerate crystalline wax, and to remove from the bottom, the heavy end, all materials which tend to dissolve and covr up waxes, if carried in too large amounts. If the product is actually taken away by fractionation and is not contaminated by entrainment of heavy materials, due to use of excessive amounts of steam which overload the vapor capacity of the fractionating equipment, the optimum product is obtained.

When a side drawn vacuum product is taken under ideal temperatures and pressure from a properly designed tower, it will be found to be of practically the same color as a well treated residue stock after being processed 35 to 40 pounds of acid per barrel, but the cold test will be much higher. This does not mean that a larger per cent of wax is segregated into this cut but indicates that the waxes are not dissolved or hidden in excessive coloring matter. It will be found that the cold test is more nearly the same as on an acid treated and filtered residue stock.

This indication leads to the idea that since the wax was free to "set" up and show cold test, it must be free of all excess wax solvent material and therefore could be completely dewaxed without further treatment for color removal. The coloring material that is present is of the same boiling range as the wax-lube-material and in the proportions to produce amorphous wax instead of crystalline wax. Amorphous wax is less soluble in naphtha at reduced temperature than the oil of the same boiling range.

For example, when an oil bearing coloring material and waxes in proportions which give amorphous wax is blended with 60 per cent. naphtha, the entire mixture is inter-soluble at a temperature of 100° F. If the mixture is chilled to 0° F. and the precipitated wax material (petrolatum) taken from the remaining solution and separated by distillation, it will be found that there has been a re-arrangement of the components and only 40 per cent (approximately) naphtha will be recovered from the petrolatum. Since the petrolatum has thrown off one-third of its naphtha and the oil has remained soluble in naphtha at this reduced temperature, all the excess naphtha goes into the oil component solution. This brings its per cent. of naphtha to 60 (plus) per cent., depending on the amount of petrolatum separated. If the same experiment is carried on with an oil carrying wax of a crystalline nature, (either due to lack of coloring matter or of a lower range boiling point waxes), it will be found that the waxes can be precipitated, but upon distillation it will be found that they still carry nearly the full 60 per cent. naphtha.

It is this change in solubility that accounts for the fact that amorphous waxes can be centrifuged and crystalline waxes cannot. The re-arrangement of the naphtha n this way sets up two components of different density, that is, a wax-naphtha component (60 per cent. wax, 40 per cent. naphtha) and an oil-naphtha component 40 per cent. oil, 60 per cent. naphtha). Since the wax and oil of the same boiling range are practically the same density, the percentage of naphtha determines the density of the component. It is readily seen that changes of these proportions make considerable difference in density.

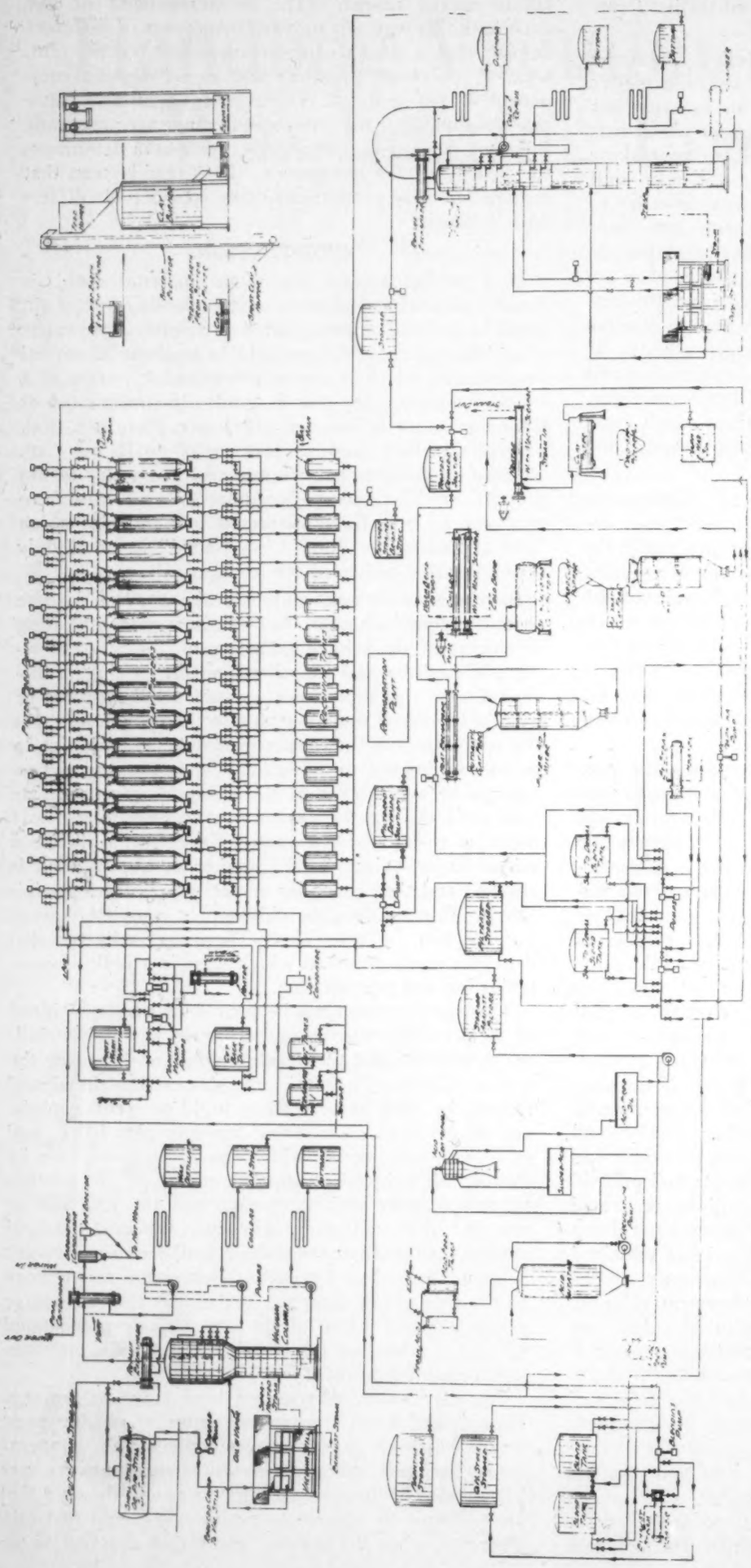
PRECIPITATION

If a perfect solvent precipitant material could be found, all the wax from a certain boiling range cut could be isolated or precipitated in a fairly close range of melting points. With naphtha as a solvent at normal temperature, which is also a precipitant to waxes at a reduced temperature, wax is gradually precipitated as the temperature is lowered. However, there is a peak of crystallization from mixtures of 60 to 70 per cent. naphtha, in the temperature range of from plus 50° to plus 30° F. This definite precipitation is a result of coagulation of very finely dispersed wax particles which first appear in the form of a "cloud" at or slightly above the first indicated temperature.

As these amorphous particles take a more definite form at around plus 30° F. there is a sudden shifting or change of the solvent arrangement, the wax throwing off naphtha and the oil taking on all that is discarded. At this time there are still small particles of wax in the cloud stage, but due to the change in naphtha concentration, they are immediately set back, due to an excess amount of solvent and greatly reduced percentage of waxes even at the lower temperature. By continued chilling the first wax continues to give off naphtha and to become more firm, but at between minus-30 and minus-40° F. another saturation point is reached and the remainder of the wax will be precipitated. This resolves the chilling for complete dewaxing into two distinct cycles. There are really two distinct saturation points at which there is a peak of crystallization and precipitation.

This same process can be proved by making a blend of 60 per cent. naphtha and 40 per cent. oil and chilling to plus 10° and then centrifuging and removing the wax available. Then take the dewaxed material and reduce the naphtha percentage to 40 per cent. naphtha and 60 per cent. oil and chill again to plus 10° F. and more wax will appear, which can be removed. Or by chilling the original mixture to minus 50° F. another saturation point will be reached and the wax can be removed by centrifuging. However, the most practical method is to continue the chilling until a saturation point is again reached at a reduced temperature and remove all the wax at one time and in this way take advantage of the physical action of the wax already precipitated serving as a nucleus for the second peak of crystallization, or saturation point.

Recently some investigators have come to the conclusion that there is a varying range of melting point waxes which are gradually precipitated as the temperature is reduced. Also that the softer waxes are the ones precipitated at the lower temperatures and the ones that are difficult to remove to produce low cold test oils. However, when the physical and chemical action of the



No. 1. Flow diagram of bright stock plant showing details of vacuum distillation, re-run distillation and clay filtration plants

solvent precipitant and the wax structure are carefully investigated it will be found that the two-stage saturation or two peaks of crystallization theory is more readily justified.

With more selective precipitant - solvent materials the waxes can be precipitated at much higher temperature and in a more defined form. From the refiners viewpoint, there has not yet been available a process using other solvent or diluting material which has the advantages of naphtha from a commercial and economical standpoint.

SUMMARY

The production ot a vacuum distilled stock from 90 vis. at 210°F. to 150° vis. at 210°F. from Mid-Continent black fuel bottoms, which can be dewaxed without further treatment, by blending with 65-70 per cent. naphtha, chilling to minus 40°F. and centrifuging, thus setting aside the raw petrolatum as a by-product; the dewaxed solution acid treated continuously and in a closed system before removing naphtha, the acid treated stock passed through percolating filters or to contact clay process; naphtha removed and result in a dewaxed, decolorized, finished lubricating stock of low cold test and with cloud test below zero; producing at the same time from the top of the tower a directly pressable wax distillate; drawing from the bottom of the tower a tar or asphaltic material, representing from 5 to 7 per cent. of the crude. This asphaltic material has not been cracked and is of high flash and fire (630° to 700° F. flash) and is free from insoluble materials or carbon or coke.

As indicated above, this method can be carried out on a side drawn vacuum distilled stock of a viscosity range from 90 to 150° at 210 F. Materials below 90 vis. carry not enough color material to inhibit some tendency to true

crystalline wax and results in less perfect dewaxing with centrifuges.

From a 90 vis. at 210° F. straight dewaxed material at 0° F. cold test neutral of 250 vis. at 100° F. can be produced, and at 150 vis. at 210° F. bright stock of below 0° F. cloud in finished color. This break-up can be made by one through-put on a solution-re-run unit which consists of a pipe still and fractionating column, taking gasoline or naphtha overhead, side-drawing gas-oil, and neutral through special stripping sections, and taking the bright stock off the bottom of the column.

Preliminary work on a laboratory scale has been under way for several months on this method of dewaxing by centrifuge and just recently a full scale commercial equipment test operation was run on a vacuum prepared 145 - 50 vs. at 210° F. stock with the following results:

Vacuum stock before dewaxing,
150 Vis.
540 flash
85-90 C. T.
Green color
20.8 Grav.

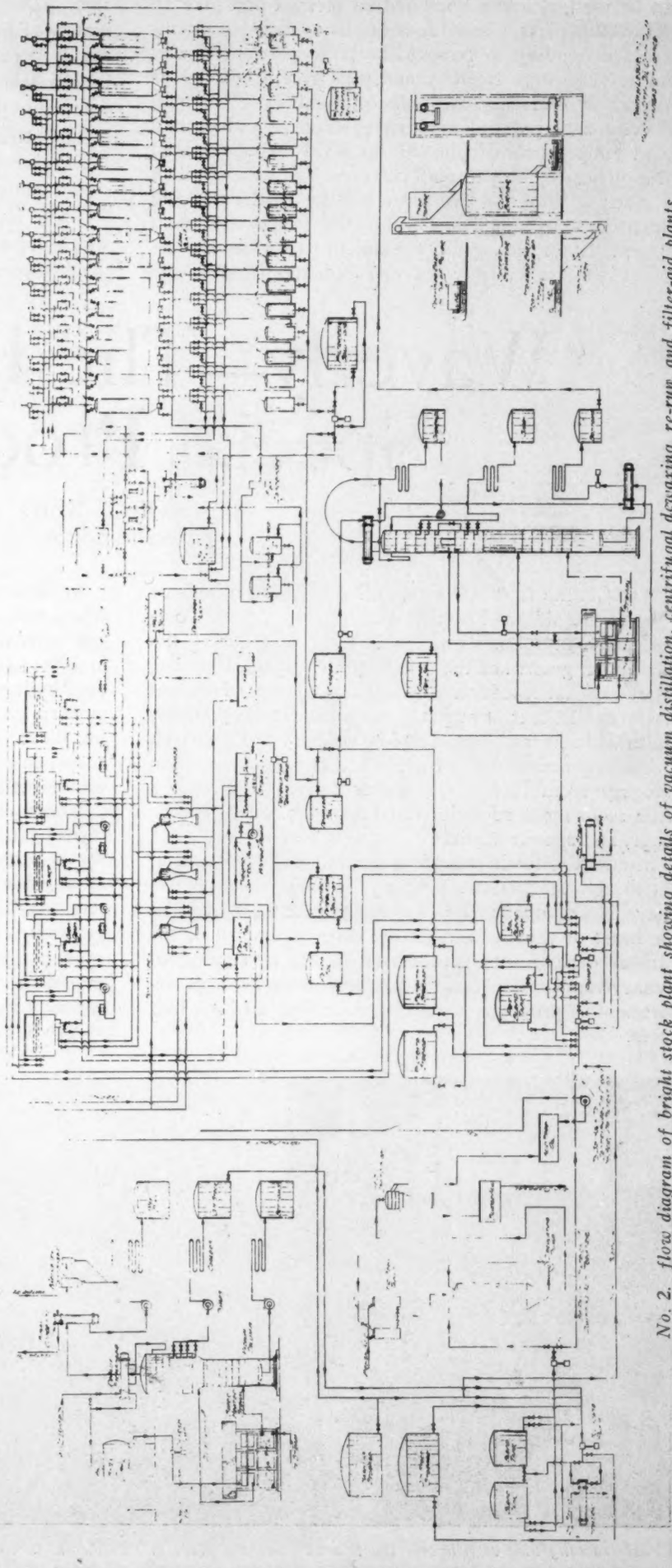
Blended 68% Naphtha, Chilled to minus 40° F., Centrifuged:
Gave 165 Vis. at 210,
Plus 10 Pour (due to viscosity)
Color green

Acid treated and contact filtered at 4.5 NPA color,
Grav. 21.4
Flash 535
Vis. 150 at 210
C. T. plus 5 (due to viscosity)
Cloud,-No cloud at -(minus) 30° F.

Blended with minus 4 degrees C. T. 200 vis Neutral in 50-50 proportions,
Gave blend with - (minus) 5° F., C. T.

At the same time some preliminary work has been done toward dewaxing this material by the filter-aid method. Very satisfactory results are obtainable. This process is being gradually developed to fit commercial requirements. There is also being developed a line of filters which improve the mechanical features which have heretofore constituted the chief handicap. Its advantages are that less diluting material is required and equal dewaxing results as compared to centrifuging can be obtained at much higher temperatures. These two features mean that less refrigeration capacity is required per barrel of finished stock.

Combination of the filter-aid method with centrifuges or cold-settling have also been investigated. It is possible that the advantages of the two processes



No. 2. flow diagram of bright stock plant showing details of vacuum distillation, centrifugal dewaxing, re-run, and filter-aid plants

can be worked into a combination method and give an improved process. Centrifuges can be operated at a temperature required to remove the large portion of wax and at very large capacity and thus give a continuous method of removing the bulk of the wax. This can be done with reduced naphtha percentage and carried on at temperature of plus-20° to 30° F. The dewaxed solution bearing only a small percentage of wax can then be given a filter-aid treatment for the final dewaxing which can be accomplished at a higher temperature than by centrifuges alone, and the amount of filter-aid required is much reduced, thus giving better filter operation. The same combination applies to cold-settling, which affords the cheapest means for taking out the major percentages of petrolatum. In this case it will be advisable to centrifuge the cold settled bottoms for complete oil recovery.

The attached chart shows the naphtha-petrolatum relation during the chilling process, and also the rate of crystallization against temperature.

There is no reason why the use of special and selective solvents for dewaxing and treating can not be applied to products obtained by this method of distillation.

Waverly—The Home of Special Products

By GEORGE REID
Associate Editor

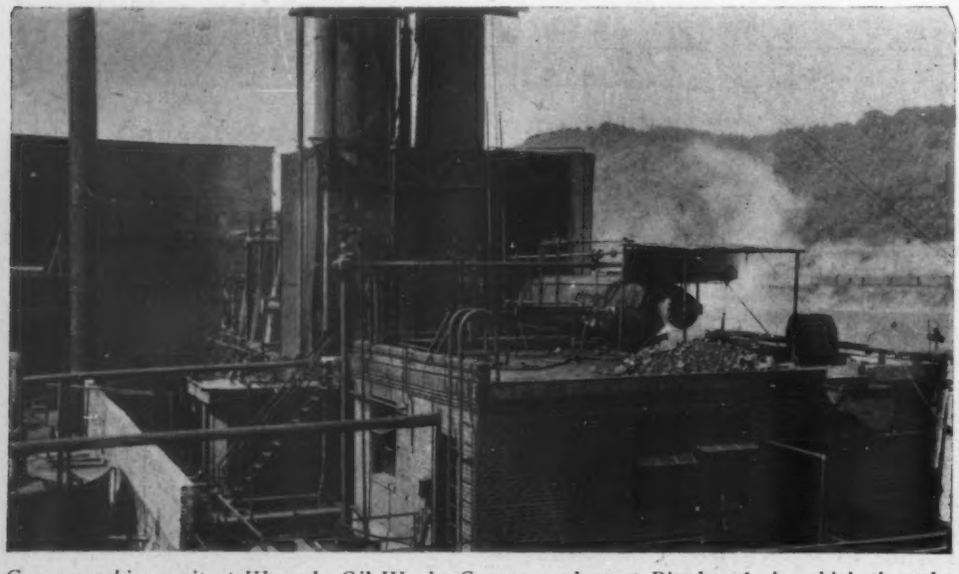
SINCE the first 50-barrel still was placed in service on the old yard of the Waverly Oil Works Company, in 1880, by S. M. Willock, and during the subsequent growth of the company, the organization has given especial attention to the manufacture of special products. In fact, it might be said that special products built this business. The complete refinery at Pittsburgh produces practically all of the products in the petroleum category from fuel oil to rubber solvent, including a wide assortment of industrial lubricants, oils, greases, soaps, and special naphthas.

In addition to the complete special products plant at Pittsburgh the present company operates a second refinery at Coraopolis. The Pittsburgh plant is located in the heart of the city's industrial district, and all of the various departments conjunctive to the processing of Pennsylvania crude for the production of its wide assortment of products, are grouped on four and one-half acres.

In the early nineties the company installed the largest steam still ever built up to that time, and this still is in operation today. Its wax plant was originally installed in 1900. In 1902 the first 12,500-gallon steel tank car ever built was delivered to the plant. In 1919 its large modern plant, consisting of a brick and concrete building six stories in height, for the manufacture of greases, soaps, and soluble oils, was erected. The Cross cracking unit came into service in 1925.

The foregoing briefly gives some of the salient historical facts concerning the Waverly plant. It is one of the best known refineries in petroleum circles, because of the fact that its well known "Waverly Hand Book" has been used as a reference by refiners and oil men generally, perhaps to a greater extent than any other company publication. And to this day, a refinery superintendent's desk without its "Waverly" is a rather uncommon sight.

At the Pittsburgh plant, nothing but Pennsylvania crude oil is processed. This plant is a complete unit, having its skimming plant, cracking unit, pipe still, grease plant, wax plant, filter house, treating plant, compounding plant, warehouse and loading facilities, all grouped closely on the banks of the Allegheny River.



Cross cracking unit at Waverly Oil Works Company plant at Pittsburgh, in which the tube supports in the furnace have been increased to greatly decrease tube failure

OPERATING SYSTEM

Crude entering the refinery first passes through a series of steam stills of the type once common in refineries, called cheese-box stills. In this operation the light gasoline is removed by steam distillation. From this system the oil is taken to the five large

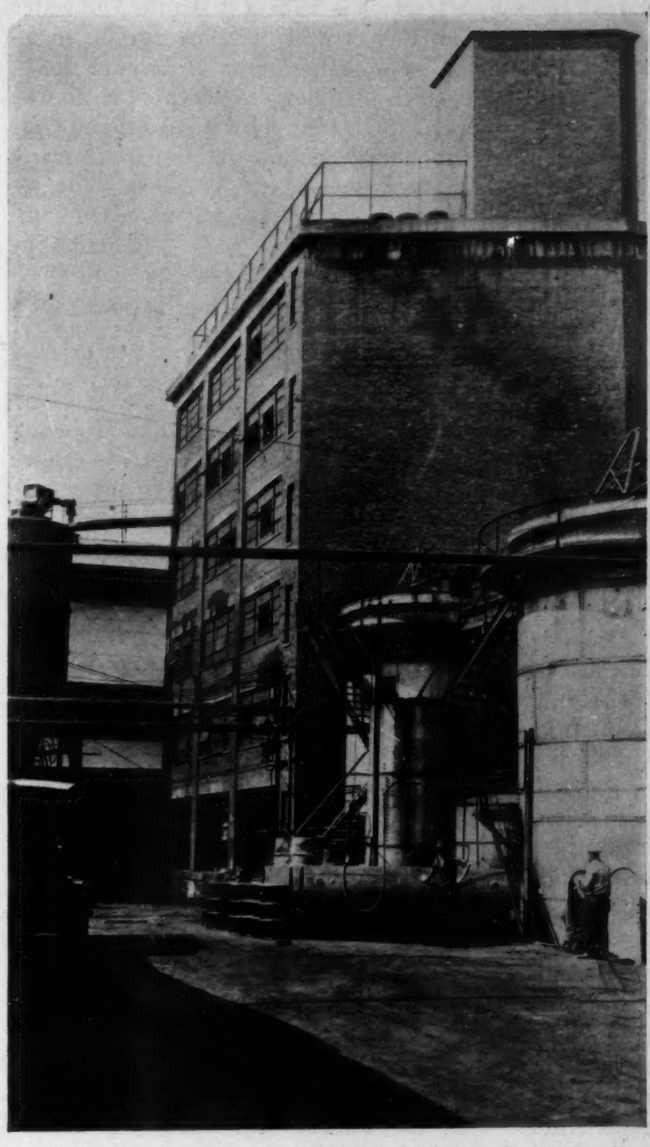
shell stills, termed fire stills at this plant, which are fired with coal, and the crude is reduced to residuum or cylinder stock. The complete skimming operation yields gasoline, kerosene, lube distillate and gas oil, in the usual sequence convential with the manufacture of lubricating oils. This and other stills on the yard are used for reducing wax distillate and other fractions in the usual manner.

Gas oil produced from the crude is sent to the Cross cracking unit, which has a capacity of 1000 barrels per day. As previously stated, this unit has been in operation since 1925, running an average cycle of 11 to 14 days. As originally installed the Cross furnace was provided with but one centrally located brick support for holding up the long tubes and to prevent them from sagging. Superintendent J. T. Malone decided last year, when it became necessary to replace several tubes in the pipe still, to provide additional supports for the tubes. Previous to this improvement the tubes had a tendency to pull and sag as they grew older, and tube failure due to splitting was not uncommon. Through the installation to two more steel supports, placed midway between the middle support and the ends of the furnace, and holding the tubes in place at this point, failure of tubes is now a rare occurrence. The new supports are 12 feet long, approximately four inches wide and three inches thick, and rest at the ends in the furnace walls just under the tubes. At the center of the steel supports, brick columns rise from the furnace floor and support the load at that point.

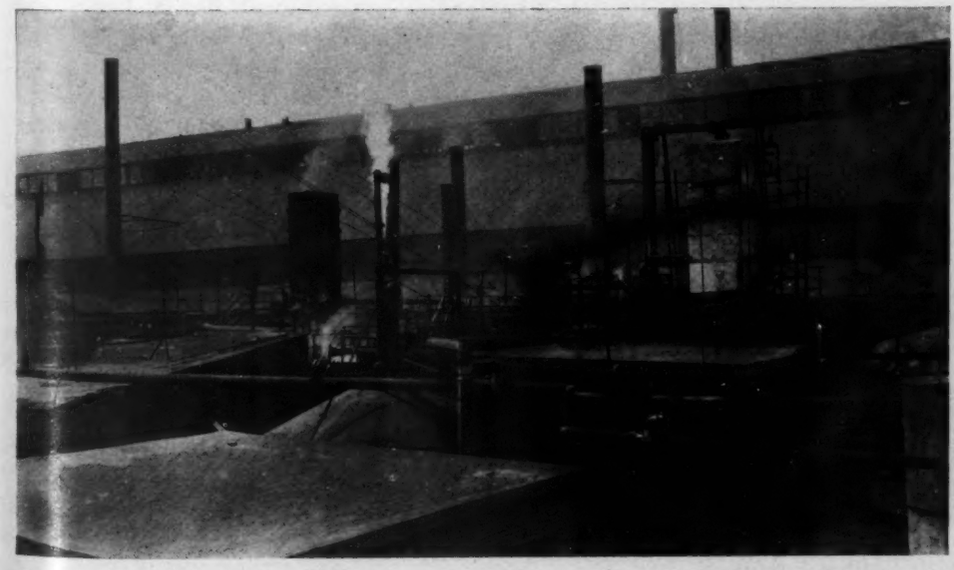
AUTOMATIC CONTROL

Pressure distillate derived from the operation of a Cross unit is processed in a rather unusual manner, in that a small Foster pipe still is employed for this purpose. The distillate for rerunning is charged to the pipe still, through a Terry steam turbine-driven Quimby screw type pump. Operating at the rate of 900 revolutions per minute, the pump charges distillate through the tube still at the rate of 40 barrels per hour.

The entire system is operated under automatic control. Brown electric recorder controllers are used. A temperature of around 400 degrees is sufficient for the vaporization of the gasoline content of the pressure distillate. The separation of residual oil, and gasoline, and the fractionation of the gasoline vapors is effected in the usual manner, through the use of a bubble tower and evaporator.



Six-story modern grease plant which produces a complete line of greases, soaps and soluble oils, as described. Portion of chemical treating plant in right foreground



Central view of Waverly plant yard. Tube still for re-running pressure distillate at right

Water for steam generating purposes, and for cooling work in the boxes, as well as for treating, is secured from four wells, 56 feet in depth. Although the plant is located on the river bank, and these water wells are not many hundred feet away from the stream, the difference in softness, or chemical characteristics in the water from the water sand is much in favor of the well production. The pumps which handle the water from these wells are all located in a pit dug beneath

a small brick house, which is 16 feet in depth. The water is distributed from this central pumping station to all parts of the plant at a temperature of around 55 F. The house under which the pumps are located is floored at the ground level with Irving subway tread, and thus provides room for storage and warehousing of many items required in plant operation. These small warehouses and storage spaces are of much value and importance in a refinery yard where space is limited. The Subway tread, such as is used to floor the water well house, is employed wherever platforming and steel steps are employed.

Water from the wells is preheated before entering the boiler plant, either by first being passed over the condenser boxes, or by going direct to the water preheater installed in the boiler house. The power plant consists of four Scott marine type boilers, which are automatically regulated as to firing through the use of Jones stokers. These stokers are automatically controlled by the steam pressure in the boilers, so that when more fuel is needed to build up steam pressures, the stokers automatically increase the rate of firing the slack coal. The ash from the combustion of the coal passes from the furnaces into a gathering duct below the boiler house floor. It is blown, or sucked (at present a steam vacuum system is used) from this duct to a large tank outside of the boiler house. When it reaches this tank it is met with a stream of water which keeps it cool. Periodically the tank is emptied of its ash content by lowering it through a trap shoot, and into trucks for hauling away.

FILTER HOUSE

The usual equipment required to produce the full number of various lubricating oils is grouped together in a separate department. Two large Carbondale presses are employed for the removal of wax from the chilled distillate. The filter house consists of 14 percolating type filters, with the burner for reclaiming fuller's earth located nearby.

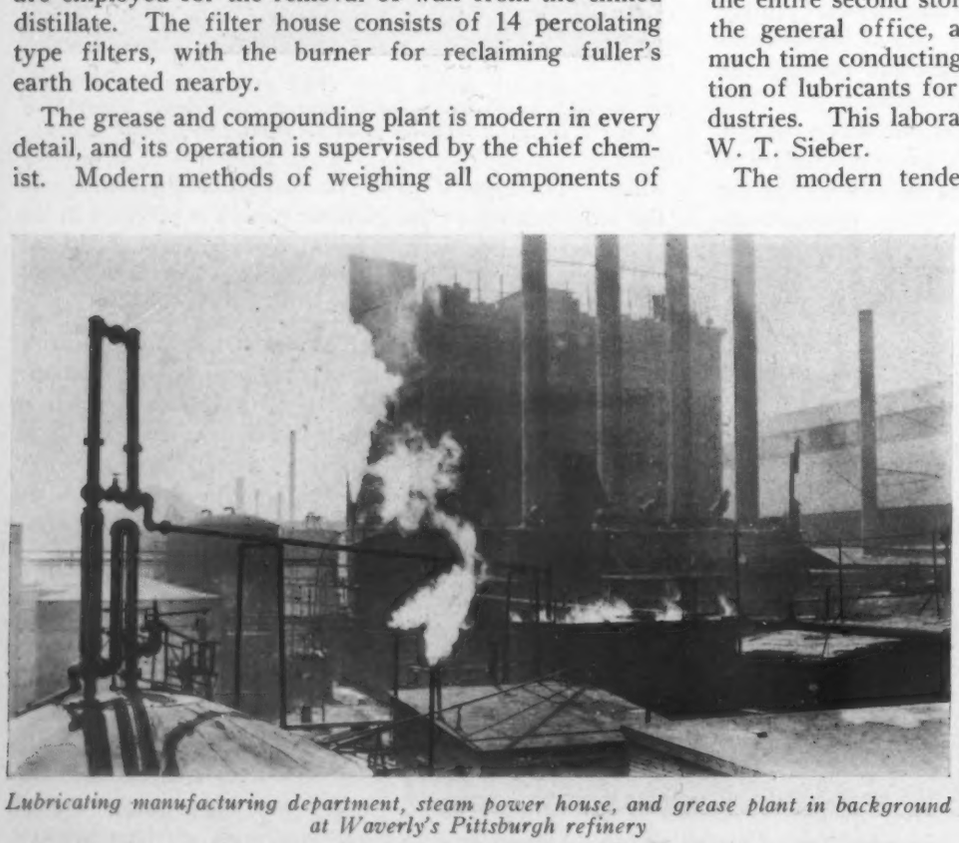
The grease and compounding plant is modern in every detail, and its operation is supervised by the chief chemist. Modern methods of weighing all components of the various greases and soaps produced, are employed. Material employed in the kettles is weighed into them, and this practice not only gives accurate control of the processes, but effects their scientific compounding, as well as giving positive means of determining costs of manufacture. The grease plant is housed in a new steel, brick and concrete building six stories high, with the actual work of preparing the products performed in the two upper stories, and the remainder of the building given over to packaging, canning and crating. Materials going into this plant consist of all of the essential petroleum oil, and a large number of vegetable and animal oils, along with the various chemicals necessary for the processes.

The grease plant produces a varied line of products. Such specialized products as elevator oils and greases, fibre greases, gear and graphite greases, journal lubricants, roller bearing greases, shafting greases, tallow compounds, wire drawing, wool yarn elastic greases, and a number of others which are demanded by a large number of industries. In addition the usual range of products for automobiles is compounded, such as universal joint grease, transmission oils and greases, cup grease, chassis lubricants, in fact the full line of automotive greases, in the varying grades. A number of soaps are produced, and several soluble products. The plant products, including the four grades of gasoline marketed, the two kerosenes, and the various motor oils, along with the group of special products, some of which were mentioned above, totals 94—and practically each of this number is produced in many grades, all with differing specifications.

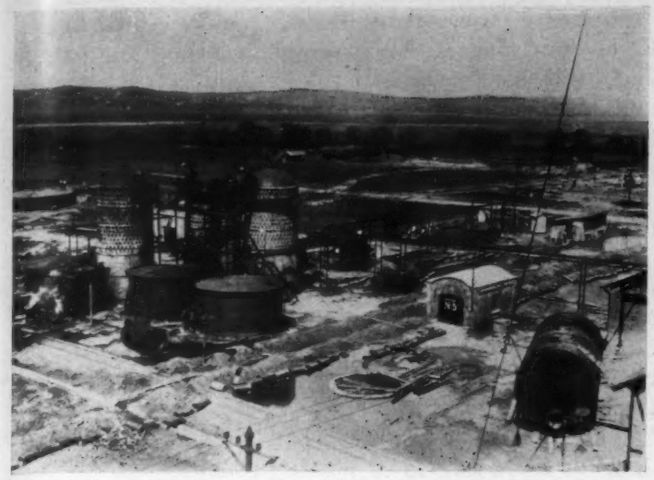
Such a volume of products of such differing specifications involves not a little research work and necessitates the maintenance of a large and well equipped research and routine laboratory. The plant laboratory occupies the entire second story of a large building just back of the general office, and the staff of chemists spends much time conducting research necessary to the production of lubricants for the servicing of a great many industries. This laboratory is under the direction of Dr. W. T. Sieber.

The modern tendency toward the manufacture of specialized products by many refineries has been discussed very much during late years. At the Waverly plant the preparation of special products, whether it is gasoline, kerosene, naphthas, special distillates, lubricants, fuel oils, greases, soaps, or soluble oils, has been almost a habit since the early nineties, and the plant may be cited as an outstanding example of the specialized refinery in this country.

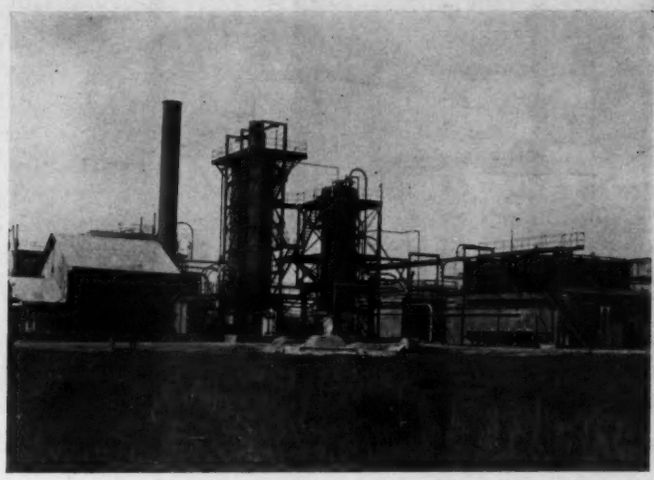
The executives of the company are T. J. Hilliard, president; H. R. Hilliard, vice president and treasurer; D. W. Hovey, vice president, and J. E. Johnson, assistant treasurer.



Lubricating manufacturing department, steam power house, and grease plant in background at Waverly's Pittsburgh refinery



Lubricating oil agitators and auxiliary equipment at Teleagen



Cracking coils of Romano-Americano refinery at Teleagen

Roumanian Refineries

By H. E. CASSIDY

PRIOR to the World War there were 63 refineries operating in Roumania. These belonged in all cases to foreign concerns and probably 60 per cent. of them were wrecked during the exodus of the Roumanian army when the Germans started pouring through the northern Transylvanian passes. The number includes every conceivable form of process known and used up to that time. There were small antiquated tower topping stills "cracking" process of distillation had not been in- and complicated systems of chemical treatment. The stalled in the sense that it is known today. One of the most popular of intermediate systems was known as the Henedrson method. This had been introduced by the Phoenix Oil Company in as much as Henderson was an Englishman connected with the Broxburn Oil Company, Ltd., at the time of his discovery. The process involves the carrying of the crude from storage through a pre-heater by means of gravity. After its pre-heat it enters the first still where it is raised to distilling temperature with a distillate of fixed specific gravity. The crude oil feed is continuous, all residue in the first still being drawn off by a bottom connection and passed into still number two of the series. Here it is raised to a higher temperature, resulting, of course, in a distillate of higher specific gravity, the residue being carried into the third still and so on until the residue crude reaches a point where all volatile gases have been extracted.

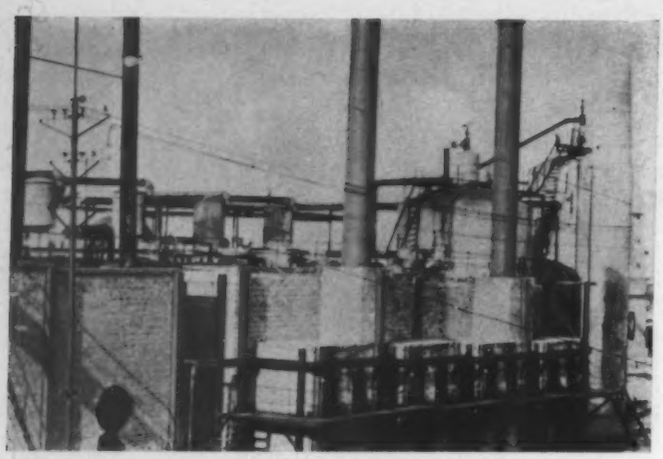
In a way, the destruction of many Roumanian refineries was a benefit. If wholesale destruction had not been practiced as a war time measure, the refinery business no doubt would have continued in a backward and inefficient manner over an indefinite period. As it is, the rebuilt refineries are using the up to date American equipment and using methods of refinery practice very similar to those used in the largest American refineries.

1928 CAPACITY

The 1928 capacity of all Roumanian refineries was approximately 40,000,000 barrels and there was a great deal of talk the later part of the year of increasing individual refinery capacity both at the Asta plant and at the Romano-Americano. It is doubtful, however, in light of the recent depression of the world petroleum market, whether these additions will be made. Not all of the refineries in Rouminia have adopted the cracking process by any means. The biggest and most important have, which probably means that the greatest share of refined products are of the cracked variety. On the other hand the large cracking units are outnumbered by the small "straight" distilling or "topping" plants. Before the war the Steaua Romana refinery in Campina was the biggest in Europe and the third largest in the world. Just what its present ranking is cannot be determined with any accuracy, but its capacity has been appreciably reduced.

In the transportation of the crude to the refineries and the transfer of refined oils to shipping points both tank cars and pipe lines are used. The tank car or "cistern" method of transportation is really the one to which all operating companies have turned. The reason for this lies in the poor state of repair in which the pipe lines are kept and the limited capacity which they have. There are 3200 tank cars in Roumania but this number is far too few. In this group there are both the 10 and 15 ton capacity type.

As to the pipe lines, they are four in number and



Close up of crude stills, Romano-Americano plant at Teleagen

aggregate about 475 miles of line, with a capacity of 7,500,000 barrels. Two run to Constantza on the Black Sea, one to Giurgiu on the Danube and one to Bucharesti, all owned by the government.

Besides these government owned lines there are about 1250 miles of private company owned pipe lines. In August 1928 nine trains of oil were leaving daily for Constantza from Ploesti while three left for Giurgiu.

Although production of crude is increasing daily, running now around 85,000 barrels daily, the existing refineries considered in toto are able to run this production. In fact this figure indicates that the refineries are running 30 per cent. under capacity. Previously the rated yearly capacity was given as 40,000,000 barrels of crude. At the present time only about 90 per cent. of the crude produced goes through the refineries. Figuring on the basis of 100 per cent. 85,000 barrels a day would give 30,600,000 barrels of oil handled by the refineries yearly less 10 per cent. which does not go through the still leaves around 27,000,000 barrels of crude actually run against a 40,000,000 capacity.

Roumanian refineries can be roughly divided into three groups. The first of these embraces the large refineries of Steaua, Astra, Romano-Americana, Credit Miner, Concordia, Uniera and Columbia, which handle 80 per cent. of the entire refinery output. The second group takes in the medium sized refineries of the Petrol Block, Acquila, I. R. D. P., Redeventa, Petrol Bucharesti, Petrolmina, Cometa and others. This group totals about 11 in number and handles 17 per cent. of the remaining production. The balance of three per cent. is taken care of by six small refineries which constitute the third and last group. Present production is about double that before the World War.

Battery of look boxes for lube stills at Teleagen

The refinable qualities of the oils are given by fields as follows. All crudes are asphalt base, the non-paraffin coming from the fields of Moreni, Gura Ocnitei, Bustenari, and Biacoi. The semi-paraffin comes from one field only, that of Runcu. Parafiin crudes are derived from Moreni, Ochiuri, Gura Ocnitei, Baicoi, Ceptura, Arbanasi and from various districts in Moldavia or northern Roumania.

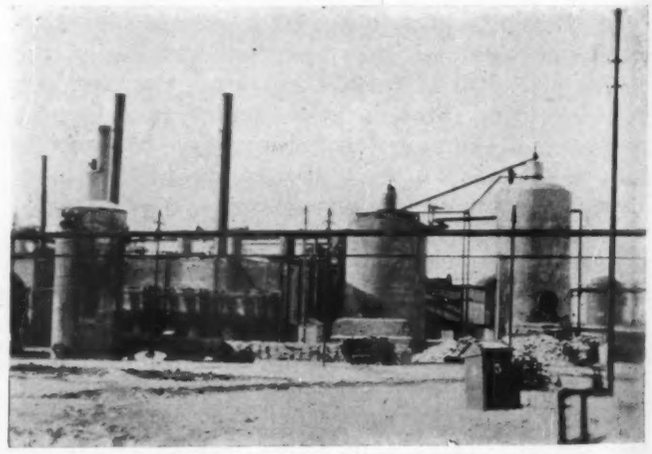
The yield which varies in refineries and localities runs approximately as follows:

15 per cent., naphtha.
25 per cent. refined oils.
5 per cent. gas oils.
50 per cent fuel oils (including lubricating oil, pitch and wax).

95 per cent.

CRUDE EXPORTS PROHIBITED

Export of crude oil is forbidden by the government which complicates the producers' problems.

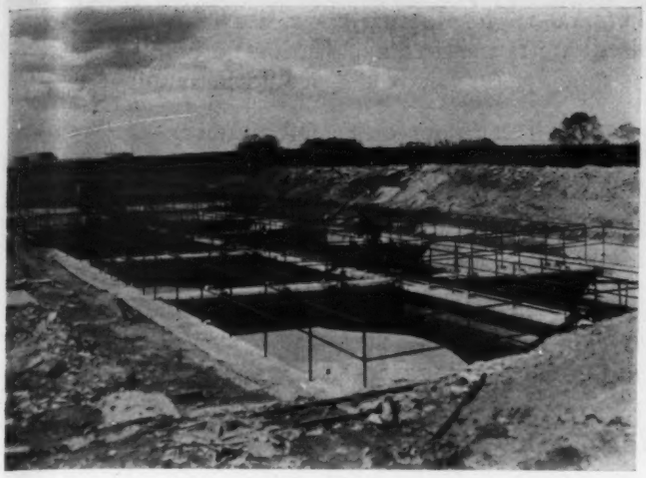


Side view of crude stills at Teleagen

During this same six months period the countries refineries handled 14,533,755 barrels of crude oil. During this same six months period the countries' consumption of oil was as follows:

Type	Amount	Percentage of crude
Napthas	341,512 barrels	2.3
Refined Oil	425,910 barrels	3.0
Gas Oil	429,262 barrels	3.0
Fuel Oil	2,650,050 barrels	18.23
Various Lubricating Oils	131,692 barrels	.91
		27.44

The refineries used 1,054,147 barrels of fuel oil, or 7.25 per cent. of the total in their own operations,



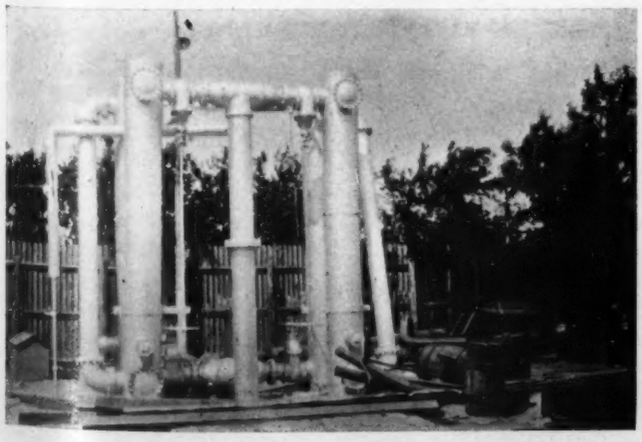
Open vat type oil separator at the Teleagen farm of Romano-Americano

the balance was exported and sold to the domestic trade.

Construction of the refineries and their operating methods do not vary a great deal, because in their initial stages they were patterned after those in the Russian and Polish fields. In general the stills are set up in continuous running batteries of seven to 14 still. In the line are shell stills, internal fired flues, dephlegmators (bubble towers) vapor and tar heat exchangers. The tar is stilled in vacuum stills.

Only the larger refineries mentioned in the first group have cracking units and lubricating oil plants. Only one refinery, that of the Steaua-Romano has a wax plant. This Steaua-Romano plant is the first large refinery to be built in Roumania and the balance of the large refineries had their initial construction in 1905. In operating the cracking process five use the Dubbs system while the Romano-Americana has the Tube and Tank process.

The six largest refineries are complete in all detail and produce practically every by-product of crude, with the exception of paraffin. There is no domestic market for this and export costs, plus customs duties and incidental tax, prohibits its export. The Romano-Americana maintains a plant for isophrophyle alcohol. The tank capacity at the Romano-Americana refinery is 750,000 barrels, while that of tanks located in various portions of the field aggregate in the neighborhood of 250,000 barrels. At Constantza there is another tank storage unit which could handle up to 200,000 barrels, giving all told a maximum storage capacity of 1,150,000 barrels.

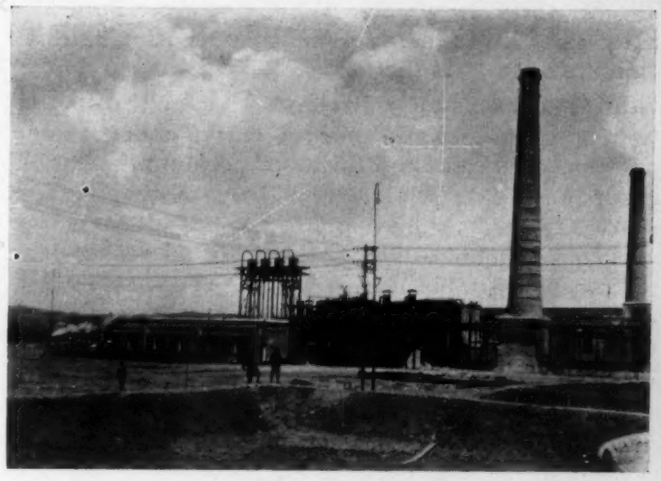


Rear view of lube stills and tail house

The cracking plant at the Romano-Americana is a one unit Ellis Tube and Tank Process which has been operated approximately one and one-half years. Since its original installation it has been enlarged and considerably modified to handle the increased run. It is believed that one and possibly two new units will be installed the first of this year.

One of the most recent and progressive moves made by Roumanian producers is that of a refinery association. Local oil companies could well afford to follow the example set by Roumanian concerns in light of the present price cutting war. This refinery association makes a complete pool out of the refinery end so that prices are stabilized and internal competition eliminated.

Until the outlook for the oil industry shows a definite improvement, it is doubtful whether a number

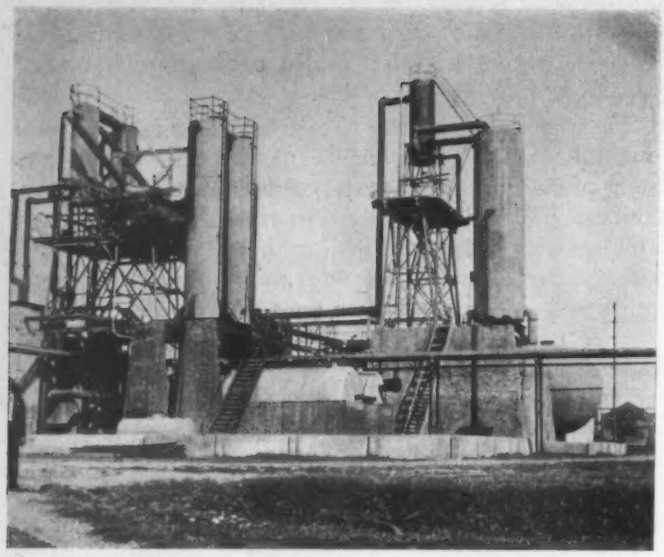


New scrubber installed at Biacoi

Roumanian Petroleum Activity
1913-1927
(U. S. Bbls.)

Year	Crude Oil Prod.	Dom. Trade Deliveries	Export
1913	14,140,673	6,086,040	7,773,345
1914	13,261,493	5,870,820	4,905,180
1915	12,178,478	6,006,973	3,218,153
1916	9,367,710	[1]3,187,275	[2]1,610,423
1917	3,277,043	.....	.....
1918	8,399,738	.....	.....
1919	6,898,853	3,537,555	292,003
1920	7,757,498	3,941,970	1,852,478
1921	8,498,940	3,621,465	2,715,713
1922	10,266,968	5,558,025	3,266,695
1923	11,323,530	5,933,633	2,874,128
1924	13,884,413	6,111,713	3,258,765
1925	17,373,780	6,999,330	5,906,173
1925	24,309,968	7,922,115	11,197,148
1927	27,417,795	8,217,960	14,347,365

([1]For seven months. [2]For six months)



Side view of stills at Steay-Romano near Ploesti

of new refineries under consideration will be erected. Two or three companies, including the Creditul Miniere and the Industria Romano de Petrol, are the chief instigators of the new refinery plan.

In Roumania the matter of refining, transportation and marketing is one of extreme importance and one of the most difficult of accomplishment, if a fair profit is to be shown on the year's books. The percentage of the total production obtained in the various districts has been worked out over a six-year period in the table shown below. The Dambovitza district is the only one to show a steady upward trend over this period.

DISTRICT	FIELDS	1922	1923	1924	1925	1926	1927
Prahova	Campina, Moreni, Baicoi, Bushtenari, Runcu, Bordeni Chiciura, Captura, Tzintea	77.37	71.05	79.82	79.82	69.89	66.52
Dambovitza	Ochiuri and Gura-Ocnitzei	13.12	20.23	12.08	13.02	24.70	28.48
Buzau		6.71	5.94	5.48	4.98	3.74	3.19
Bacau		2.80	2.78	2.62	2.18	1.67	1.81

With the exception, perhaps, of the Romano-Americana refineries at Teleagen, the refineries in and around Ploesti have ample capacities at the present time to handle such production as the field yields. Most of these refineries, at least the largest of them, have been modeled as closely as possible after American installations. Not all of the refinery equipment is manufactured in America, a percentage of it being purchased in England and Germany, but the "set-ups" and technical methods of procedure follow American standards.

Egypt and Italy are Roumania's best customers, with England coming next. Although the war existing between the Shell and Standard Oil interests seriously handicapped the Roumanian industry in marketing its oil in 1927, a marked increase was shown over 1926. Now that this difficulty is cleared up and a more economical development program inaugurated, the 1928 market should improve. Exporting nearly 60 per cent. of her total production, Roumania is vitally interested in the world oil market and slight fluctuations are readily felt. If the domestic tax and transportation horizon would clear as quickly, further trouble could be eliminated.

Roumanian Oil Exports

Exports in U. S. Barrels

Country	1926	1927
Italy	1,984,342	2,612,325
Egypt	1,922,013	2,155,426
Great Britain	1,321,853	1,701,053
Austria	744,255	1,118,290
Hungary	659,107	1,080,510
Germany	656,610	1,064,018
France	1,042,890	814,674
Other Countries	2,876,078	3,600,847
	11,197,148	14,347,140

While not the largest, the Romano-Americana refinery is perhaps one of the cleanest and most up-to-date installations in Roumania. It is complete in all details, refining all petroleum products from the crude, with the exception of paraffin, for which there is no market at the present time. Six-inch lines bring the crude into the refinery from the fields, with a network of four-inch tributary feed lines. A six-inch gas line runs from Moreni to Teleagen, while an eight-inch line is brought in from Boldesti, furnishing many times the quantity of natural gas desired.

The Teleagen tank farm has a capacity of 750,000 barrels. The Romano-Americana in addition has facilities for storing 250,000 barrels in the field and 200,000 barrels at the shipping port of Constantza.

The refinery laboratory at Teleagen is a model of efficiency and one which would do credit to any large refinery in America. Their only apparent shortcoming is the lack of a research department. The need for creating such a department would seem to arise from the desirability of establishing the similarities of crudes and the processes of extracting the same grade of benzine from varying crudes. The present laboratory force is at work day and night, testing refinery runs. With the exception of the chief chemist, G. Lansing, trained with the Standard Oil Company of New Jersey, the chemists and helpers are all Roumanians. The force includes 20 men.

EXPANSION NEEDED

As has been previously stated, the Teleagen refinery is the only one being operated beyond capacity. This applies to both cracking and refining processes, so that if development and drilling work continues there will be a pressing necessity of refinery expansion.

All the chemicals used in the laboratory are imported from Germany, most of them being shipped down the Danube by boat. This method of transportation is naturally slow, so that a large stock of chemicals is always kept on hand.

In the paraffin base crude is found high boiling points with low gravity, while the asphaltic crude is just the reverse. Standard light naphtha as mar-

keted requires 60° to 100° C., with a final 150° run. A typical paraffin base crude will have a specific gravity of .710 to .720, while the asphaltic base runs higher, ranging between .725 and .730. The Astra and the Romano-Americana are the only refineries in Roumania at the present time giving triple tests, namely—the American, English and Continental methods, for all of which they are well equipped. In fact, all their laboratory methods are modern in the extreme and their equipment very much up to date.

Romano-Americana is operating approximately 600 tank cars for the transportation of refined products. Part of these are rented, part owned on the basis of a 25-year lease and some owned outright. They are also proud in the possession of two locomotives, veterans of the trying days of '19 and '20. After the war it was necessary for a period of years for them to operate their own trains to Constantza and Bucharest, although they ran over government lines. These locomotives are used to bring men from Ploesti to the Teleagen camp in the morning and return them at night. The personnel in the refinery and shops runs around 1,500 men, so that transportation of these laborers is a problem in itself. The tank cars are of 15 and 10 ton capacity or roughly 105 and 70 barrels. The 10 ton or 70 barrel car has come to be regarded as standard, however.

The average gravity of the oil produced is 33° Be., of mixed base. Camparison of oil analyses from two fields is given below.

PRODUCT	BAICOI	MORENI
Light Benzine	4.28 per cent.	35.38 per cent
Heavy Benzine	15.68 per cent.	9.29 per cent.
Gas Oil	10.27 per cent.	8.17 per cent.
Kerosene	27.75 per cent.	14.99 per cent.
Fuel Oil	41.07 per cent.	32.01 per cent.

The smallest refinery in Roumania today is a crude unit with a total capacity of 100 barrels per day.

The present cracking plant at Teleagen is a one unit affair. It is operated under the Ellis Tube and Tank Process and has been run approximately one and one-half years. Since its original installation it has been considerably enlarged and modified. Refinery heads are working on plans for a new unit which may supersede the present plant.

Not all of the refineries in Roumania are located in and around Ploesti. For example, take the holdings of the Romano Africano, a subsidiary of the Service Petroleum Company, Ltd. This company maintains a small refinery at Ploesti and another at Targoviste with a short pipe line from the Gura Ocnitzei producing area. The total capacity of all refinery equipment for the Romano Africano does not total more than 7,000 barrels per day and from this it can be seen that outside refineries have a small production of products.

Below is shown the production of crude per company for the entire Roumanian area. Naturally, the figures for 1928 are not yet available, but it seems safe to predict that the Astra will still be the leading producer of crude. The only radical change which can appear in the company ratings will be the case of the Romano-Americana. This subsidiary of the Standard Oil Company of New Jersey has been accomplishing big things in the development lines during the past year and should raise their yearly total to well over 2,000,000 barrels.

COMPANY	Production in U. S. Barrels 1925	1926	1927
Astra-Romano (Dutch Shell)	2,947,117	4,741,515	4,453,710
Steau-Romana	2,384,645	3,098,095	4,060,882
Creditul Miniere	2,824,368	4,437,803	4,036,583
Phoenix or Unira Group (Eng.)	2,005,545	2,701,418	3,261,765
Concordia	1,118,768	2,921,535	3,164,227
Romano-Americana	1,650,240	1,595,640	1,740,930
Industria-Roamana de Petrol	1,903,785	1,342,748	1,395,585
Colombia	800,475	719,573	1,002,175
Petrolul Romanesc	231,368	104,985	794,483
Aquila Franco-Romano	69,555	538,185	324,158
Dacia-Romana Petroleum	.....	136,118	270,292
Petrol Block	196,253	278,288	221,013

Refinery output increased materially in 1927 over 1926, but unofficial reports for 1928 tend to show a still greater output for the fiscal year. Since the reduction by the government of export taxes, railway and pipe line transportation of light oils such as gasoline and benzine cracking has increased. The table below gives an idea of the amounts of refinery output for the past three years, the figures for 1928 being approximate and not official.

Output of Refineries Per Year

Products	1926 Bbls.	1927 Bbls.	1928 Bbls.
Gasoline	5,624,723	6,302,550	7,124,613
Kerosene	3,833,078	4,306,275	4,892,532
Gas-Oil	2,189,723	2,392,568	2,417,987
Fuel Oil	11,088,188	12,916,455	13,974,975
Total	22,735,710	25,917,848	28,410,107
Distillation Losses	437,618	582,248	675,859
Total Crude Treated	23,173,328	26,500,096	29,085,966

The pipe line situation in Roumania is in a rather precarious position. The double pipe line running between Ploesti and Constantza is in reality a single line for a considerable portion of the distance. This pipe line, equipped as it is with the present pumping facilities, is able to handle only refined products such as kerosene or gasoline so that the transportation of crude is limited exclusively to tank cars.

Tests of Roumanian Oil Before and After SO_2 Treatment

	Refined in the usual way with sulphuric acid and caustic soda		Treated according to the Edeleanu process with sulphurous acid.	
	I Sp. Gr.	Candle-power	Sp. Gr.	Candle-power
Bustenari	0.8195	7	0.8028	13
Campina	0.8148	10	0.7968	15
Moreni	0.8180	5.8	0.8048	11.8
Tintea	.08190	8.4	0.8088	13.2

Newly installed exchanger, preheater, and distillation equipment replacing old horizontal steam still equipment, at Rio Grande Oil Company's Santa Fe Springs plant

Modern Equipment Allows Four-Fold Capacity Increase On Same Plant Site

RIO GRANDE OIL COMPANY'S natural gasoline plant at Santa Fe Springs, California, has recently been completely remodeled and modernized. This work was done partly as a consequence of the development of a deeper oil and gas producing horizon in this field, and in anticipation of large quantities of natural gas which was certain to be available as the exploitation of the deeper zones got under way. Comparing present gas volumes against those of the past, this plant was two years ago treating 1,500,000 cubic feet of gas which was brought to the plant from the Meyer, Bell and Foix sands through two 80-horsepower Bessemer compressors. The present daily throughput averages 10,000,000 cubic feet, practically all of which comes directly into the absorber equipment at the plant from the field and at field pressure from the new deep zones.

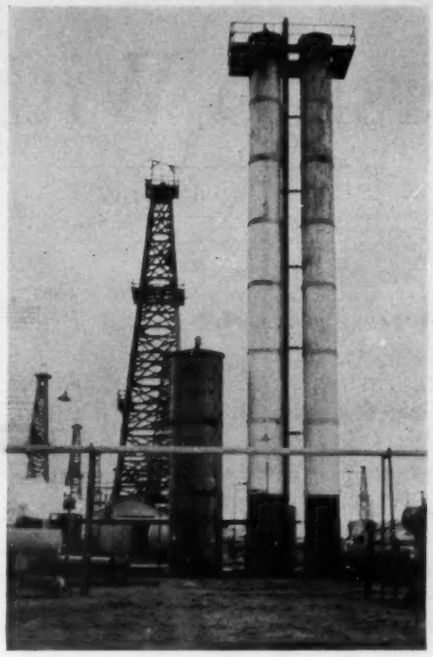
At the Rio Grande plant there is a striking comparison of the older type of plant equipment with the present compact and highly efficient absorber installations. In one of the accompanying photographs there is shown one modern absorber placed on a setting adjacent to two of the old type 60-foot steel lathe packed absorbers. The small tower is handling around 7,000,000 cubic feet of gas daily at 30 pounds pressure, while the larger and older equipment is handling around 3,000,000 cubic feet daily. The older equipment was left for handling gas during the flush period of the field's new development, after which it will be dismantled.

Mist extractor installed at top of water cooling tower. Reflux and water flow to the de-watering tank and reflux then returns back to the top of the still

INCREASED FOUR FOLD

In addition to the installation of the Campbell absorber, the company replaced its old "two-pipe" heat exchanger with modern exchanger and preheater equipment. The still replaces the old type horizontal steam still formerly used. In revamping the plant a number of other features were modernized and new materials installed to replace that which was worn or corroded. In fact the plant was given a thorough reconditioning and cleaning, and its capacity increased four-fold, without the enlarging of the buildings, and in real-

ity occupy less ground area than formerly. This plant follows the latter day policy of erecting all equipment out in the open without sheds over the stills, tower, pumps or boilers. This "open air" type plant is becoming popular and extensively employed in California and parts of Texas, although it is problematical as to the comparative benefits where roofing is used. Certainly in the colder sections much better efficiency may be expected from plant equipment which is housed, in addition to being well insulated.



A comparison of older type absorbers with the modern equipment. The small absorber is handling more gas than the total capacity of the two larger pieces of equipment

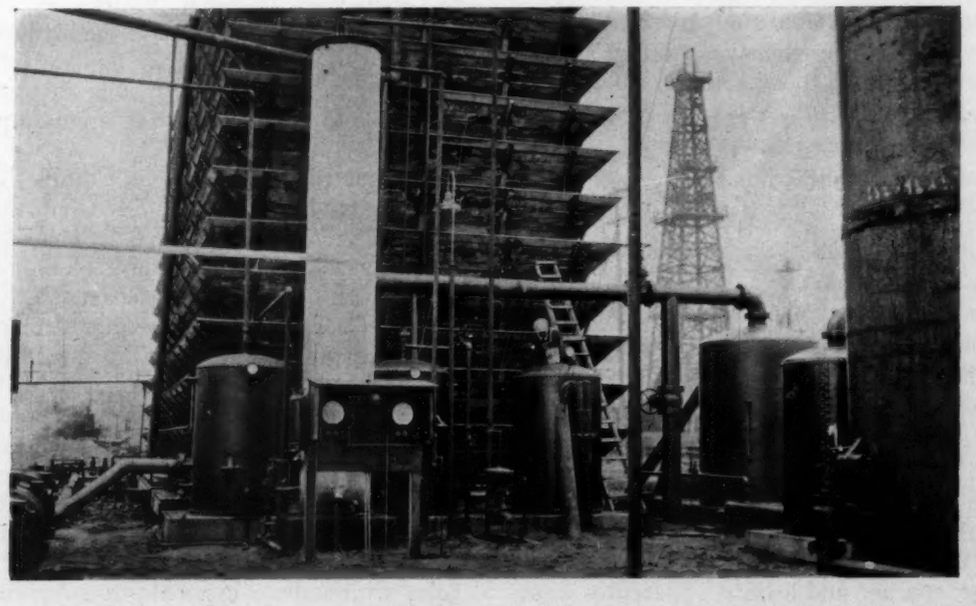
At the top of the Fluor water cooling tower a Campbell type of partial condensing dephlegmator was installed. Gasoline vapors from the still flow through the two-inch coils which are submerged in water in the long box above the tower, and then pass into the side of the mist extractor. The reflux which is condensed in the coils flows from the bottom of the extractor into a dewatering tank located on the ground. The height of the mist extractor gives "head" enough to force the reflux into the dewatering tank and back up to the top of the still, where it flows over the plates, scrubbing the rising gasoline vapors. The absorption plant operates at 30 pounds pressure and gas entering the absorbers is regulated or reduced from 37 to 42 pounds pressure to that figure. Pressure in the dewatering tank where the reflux and condensed water flows from the mist extractor is slightly higher than plant operating pressure.

Gasoline vapors from the mist extractor are taken lower into the cooling tower through two-inch coils and condensed to gasoline. This gasoline flows directly into the low pressure fractionator, entering at the top and flowing downward over the trays. This fractionator or stabilizer is three by 18 feet in dimensions. Temperature on the device is held at 135 degrees, using steam as the heating medium. As the gasoline accumulates in the bottom of the column it is permitted to escape at a uniform rate through the action of a Fisher liquid level controller. It passes through a series of cooling coils and to storage. This gasoline is well stabilized and has a recovery on distillation of 92 to 94 degrees A. P. I. with a 70-72 degree initial boiling point and 310-320 final boiling point.

Those lighter vapors which are liberated at the operating temperature of the low pressure stabilizer (operating at 25 pounds per square inch) are withdrawn from the top of the column, with flow controlled through a Wilgus regulator and passed into the vacuum line and through one of the Bessemer compressors along with gases from the shallower producing sands in the field, and thence back into the absorption system to finally work their way out through the residue gas lines.

The plant is so designed and laid out that the position of equipment forms a rectangle, with a small yard in the center, where the distillation equipment is located. Boilers, pumps, and booster plant are on one side of the rectangular site and are parallel with the water cooling tower, scrubbers, absorption towers, and receiving tanks on the other side. Water for steam generation and cooling is secured from a water well in the center of the plant site. A Layne & Bowler centrifugal pump, driven by a 7½ horsepower Westinghouse motor pumps the well. The water well is 180 feet deep with the pump set at 120 feet.

Since the plant was re-designed and improved through the installation of modern equipment, not only is the rate capacity greatly increased, but the cost of operation on the basis of cost per gallon of gasoline is greatly reduced. Labor expense remains approximately the same.



Installation of low pressure fractionator or stabilizer with control regulating devices

In Partnership With the Job

By OTTO PETERS

IN a letter, which came along with this manuscript, Otto Peters wrote:

"In this article of a man and his job, I may be accused of idealism, but I feel that the idea is based on sound fundamentals and proven by personal experience.

"It may put a different slant on the proposition and be of interest to someone determined to plug along. At any rate that's the way I feel about it, heart and soul."

IN some of my previous writings as messages to plant operators, attention had been called to the opportunities possible in different form for the men engaged in this business of gasoline plant operation. It appears to me that the man with a job that calls for constant watchfulness, constant study, and to be ever on the alert is indeed fortunate, as this kind of a job paves the way for initiative, provides an outlet for energy and ambition, and in keeping a man busy it certainly keeps him in good health because hard work has not yet killed anyone, and furthermore the first thing attributed to success by the successful man is that he worked hard and long.

It is conceded by employers that an efficient employee is essential to the successful operation of the plant, but this efficiency is not limited to a knowledge of the business. The work done and the manner in which it is done are what counts and it is well to look upon the matter in this light because the gasoline plant of today with its improved apparatus is near automatic in its operation, and the requirement of skill may be at a minimum. The human element is needed, however, to assume the responsibility of the details involved in plant operation and to merit this responsibility is the ambition of the operator, because he knows full well that in this business the man at the top has to pass up from the ranks.

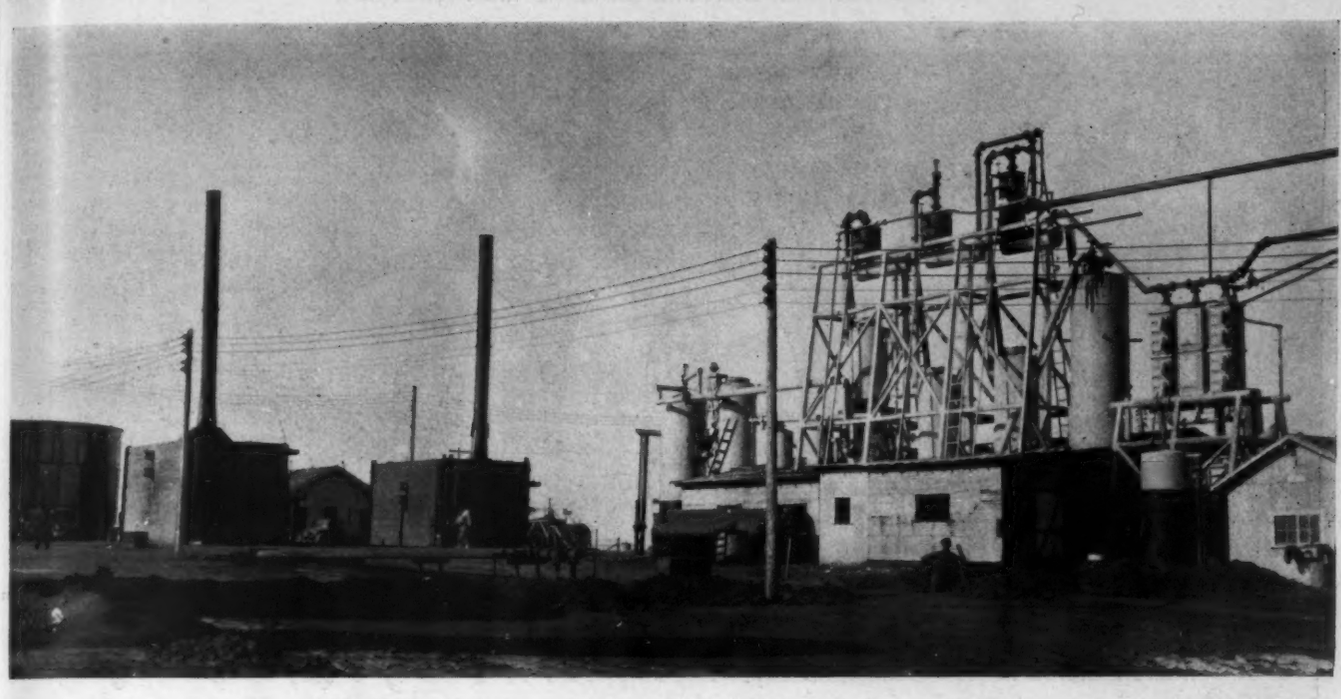
Then why is it that some men drop out, why are some not promoted, why do some stop part way? It follows that failure between a man and his job is an individual problem to be analyzed not from the viewpoint of why do men fail but rather from the viewpoint of how to succeed, and to my notion the quickest way and the only way to succeed is to make a partner of your job. In other words, enter into partnership with your job on a fifty-fifty basis with the understanding that it calls for sacrifice on your part.

In partnership one assumes the assets and the liabilities of and with the other. We are concerned then with our assets and our liabilities toward the job. The assets would be a mental, physical and spiritual development, a knowledge of the work, ambition and good character. The liabilities would be traits opposite the assets. The assets would be exercised by close attention to the work, doing the work with safety, efficiency, economy and cleanliness, with a loyalty in spirit as well as in deed. Partnership with the job exacts sacrifice of time, time from pleasure, time from home, it calls for patience and perseverance, courage and loyalty, apparently ceaseless in its demands. When we interpret partnership we must visualize the job as a live thing calling for the best we have all the time, in this way we realize instantly whether or not we are playing squarely with it, and if it should be questioned about it being all work and no play, then as a partner with the job it should be answered, our work is our play. Indulgence in pleasure can come after the partnership has proven successful.

The problem of the wage earner is wages, working conditions and living conditions, but we can construe them as assets of the job. In the same sense that the job is exacting in its demands, it is just and liberal in its awards, because in its partnership it pays back in higher wages, easier work, shorter hours, establishes a record, provides beneficial contacts and protects the future. The surprising thing then is, when the job has made its awards, we are not content to rest easy, we seek more work, and that is because we have developed our efficiency to the point of doing again as much work with easier efforts and less time, and that devolepment I claim to be the crowning award of the job.

E. P. Farmer in charge of plant operations at Magenta (Monroe field), Louisiana, absorption natural gasoline plant of the Arkansas Natural Gas and Fuel Corporation, Cities Service subsidiary, has his trouble due to high pressure. Taking gas from the company's inter-state pipe line at well pressures of 650 pounds, and higher, he passes it through absorber without any reduction of pressure. This is the highest operating pressure in this industry so far as available records show. The "green" gas has a gasoline content of 216 gallons per million cubic feet. Not enough per thousand to mention.

Over at Big Lake, Reagan County, Texas, two gasoline plants, the Big Lake Oil Company plant and the plant of the Signal Gasoline Company can get five gallons of gasoline per 1000 cubic feet, or 5000 gallons per million feet, including 10 per cent. of hydrogen sulphide gas. L. C. Thompson, superintendent of the Big Lake Oil Company's plant said that about 400,000 cubic feet of hydrogen sulphide per day was his usual quota. Individual wells produce H_2S in varying proportions, ranging from three per cent. to 20 per cent. The average content of hydrogen sulphide in the "green" gas is eight to 10 per cent. at the plant. Fuel gas for the engines is treated free of its corrosive H_2S gas before it is consumed. The finished gasoline is treated sweet and stable color with sodium hypochlorite solution.



MacMillan Petroleum Products Corporation plant, Borger, Texas

MacMillan Refinery Equipped to Condition Panhandle Crude

MacMILLAN Petroleum Products Company's Borger, Texas, refinery was designed especially for processing Panhandle crude. With the addition of several interesting features of operation and construction designed by company engineers and incorporating the principles of multiple-flash distillation, the small, compact plant is enabled to process 6000 barrels of wet, salt-bearing crude daily, producing the usual skimming plant products meeting all standard

The Borger plant is a duplicate of the same company's Long Beach, California, and El Dorado, Arkansas, skimming plants, in so far as types of still and fractionating equipment are concerned. The equipment was designed by the engineering firm of Boner & Sheldon prior to the merging of this company with the MacMillan organization, of which H. E. Boner is now manager of manufacture. Certain modifications of mechanical lay-out of fractionation and condensing equipment are included in the design of the Borger plant in order to effect the close fractionation of cuts desired, and to handle this particular type of crude.

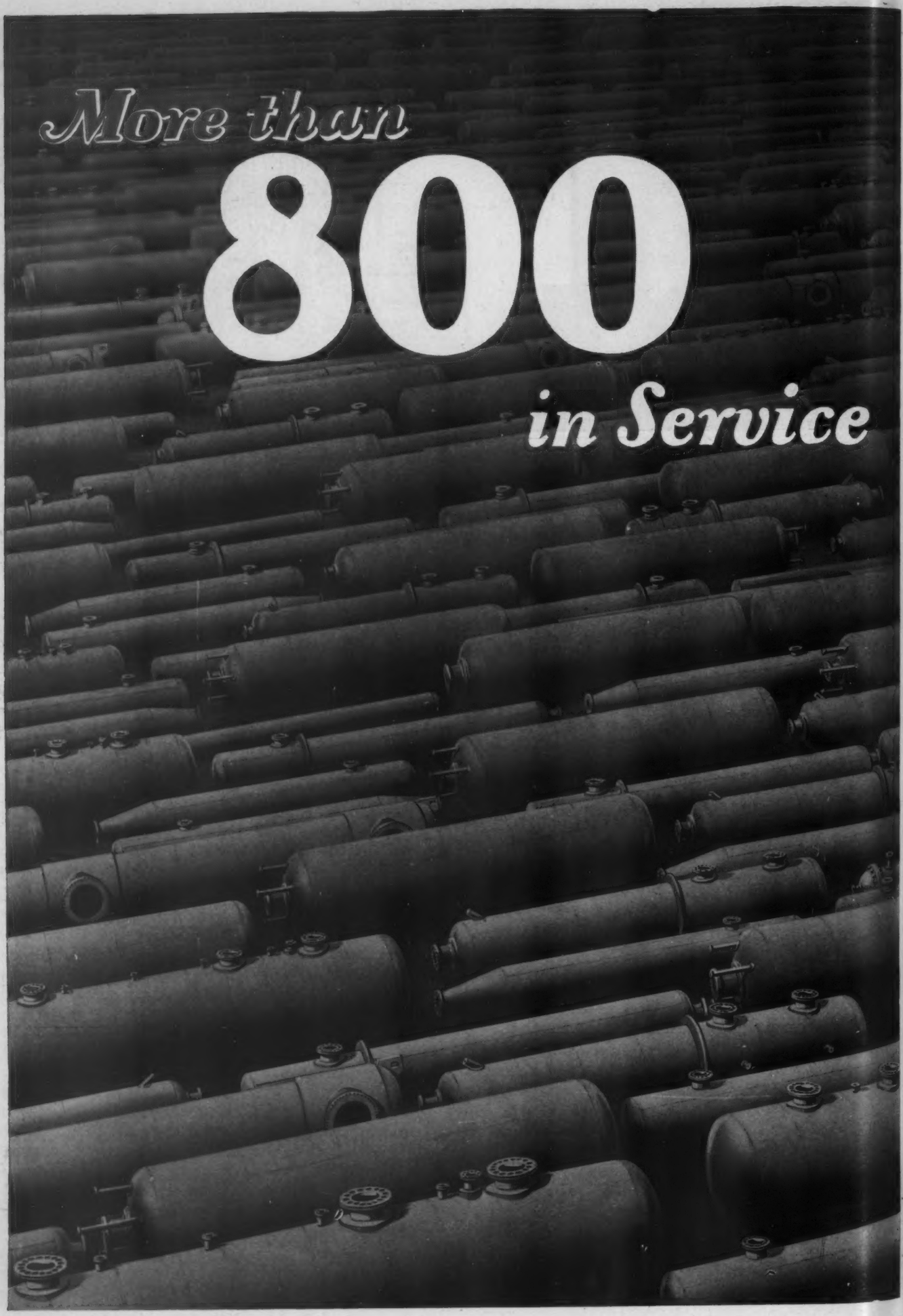
The crude being processed at Borger has a sulphur content of 2 to 2.5 per cent. Hydrogen sulphide gas is present and has offered serious corrosion problems. Salt is present in varying amounts ranging from 30 to 800 grams per barrel of oil. Salt will average around one pound per barrel. Its removal from the oil also offered an operating problem. The crude bears 28 per cent. of gasoline by Hempel distillation. Fuel oil recovery is 61/62 per cent. of the crude charged. Kerosene, engine distillate and gas oil are also produced to standard specifications.

As the plant was originally installed, the distillation was of the single flash type employing one pipe still and three fractionating columns, handling 4000 barrels daily. Desiring an increase in capacity, the company installed a second pipe still and additional washing and salt removing facilities. These tube stills are operated in series with the removal of one gasoline cut effected between heatings. This differs from the customary multiple-flash systems where different temperatures are effected by charging crude through hotter tube banks in the same still, although the results are identical.

Being very compact in arrangement of equipment and provided with all necessary automatic control instruments and operating continuously at the rate of 6000 barrels each day, the processing cost per barrel of crude is relatively low, despite the fact that the unusual problems of salt removal and removal of other foreign matter involve the operation of a complete conditioning circuit prior to distillation. The acidity of wet hydrogen sulphide gas must also be neutralized. Refining costs per barrel are said to be as low as those of other plants operating with modern multiple-flash distillation systems and bubble type fractionating columns.

CRUDE CONDITIONING SYSTEM

Prior to the application of heat for distillation purposes the crude is conditioned through the use of hot water washing equipment for the removal of some salt and salt water, through dilution and solution, and affecting a general cleansing of the oil of foreign substances. Crude is handled by Byron-Jackson centrifugal pumps driven by General Electric motors. The first pump takes suction on the crude storage tank and discharges through a series of two Southwestern heat exchanger boxes equipped with 500 feet of Shelby inter-


More than
800
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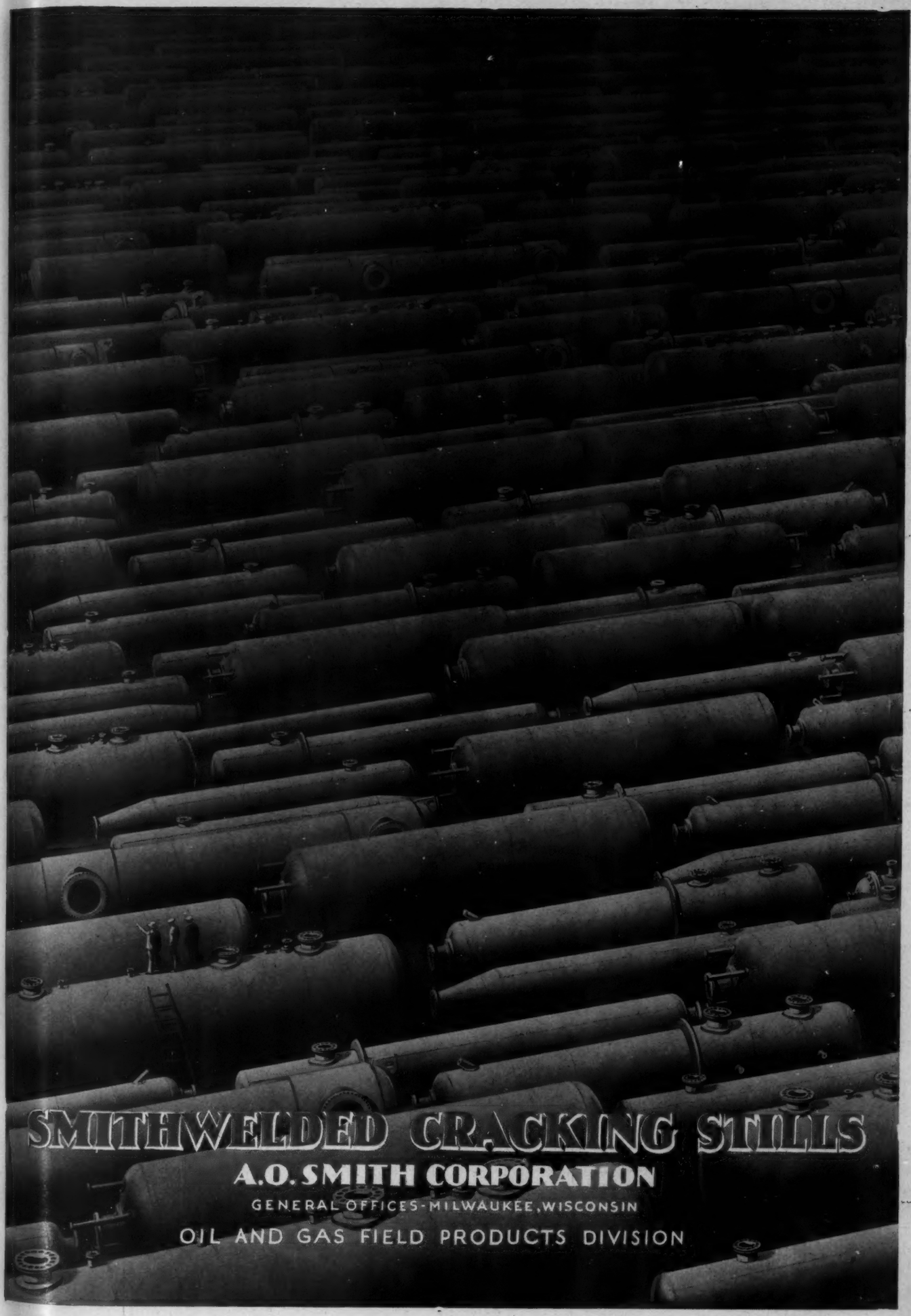
SMITHWELDED CRACKING STILLS
A.O. SMITH CORPORATION
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changer steel tubes. The hot fuel oil bottoms flow through the interchange equipment as the heating medium.

In the interchange equipment the crude at atmospheric temperature, or 70° to 80°, is raised to 200°. Leaving the final exchanger it is discharged into the bottom of one of a series of two washing tanks through a spider distributing device. These washers, like the remainder of the conditioning system, function under 60 pounds pressure. Water, previously heated to about 200° through use in the primary vapor condensing equipment, is pumped into the top of the washer-tank and flows downward counter current to the uprising flow of crude. Each washer is provided with a series of screen placed at intervals from 12 to 18 inches apart. The first washing of the crude is performed by water which previously has passed hrough the second washer-tank. The last washing of the oil is done with the fresher hot water. A liquid level is maintained in the second washer by means of a rate controller water circulating pump. The water is drained from the second washer tank to the sewer.

Flowing from the final washer-tank, the crude is taken to a horizontal settling drum. The settler consists of a cylindrical shell with baffles placed at intervals to reduce the turbulance of the incoming oil. At this point the water and sediment settle out. The drum is constructed of three-eighths-inch plate with one-half-inch heads and three-quarter-inch manhole plates. Longitudinal seams are triple riveted and girth seams are single riveted. An automatic relief valve maintains a maximum pressure of 80 pounds in the tank.

At this point the crude is picked up by the second centrifugal pump, which has a rated maximum capacity of 8000 barrels daily, and is driven by a 40 horsepower motor. The crude loses little of its 200° temperature in the washing and settling operation because of the hot water used in the wash, and the insulation of settling tank and lines. The preliminary heating by means of the two exchangers prior to washing lends ease and speed to the washing operation. It is discharged from the second pumping into the first pipe still. The still consists of 42 four-inch tubes 22 feet long. Including the combustion chamber and tube space the still is 13 feet wide, 22 feet long and 16 feet high. The combustion chamber is eight feet in height, and in the remaining eight feet the tubes are nested. In front of the retort and built under ground is a low dutch oven 26 inches high, 10 feet wide and 12 feet long. The retort is operated with radiated heat as the direct fire is confined to the dutch oven. Hot gasses and radiant heat have contact with the tubes through four passages, using flat baffles resting on the coils. The still was designed to use an excess of air to prevent burning out of tubes. Temperature of 300° is controlled automatically. The second retort is a duplicate of the first but operates under automatic control at a temperature of 525°. In the first retort which is used as a preheater for the removal of any remaining moisture and a light fraction of gasoline, the crude is increased to 300° and taken to the evaporator for separation.

From the evaporator, which is 5 feet by 25 feet in dimensions, the overhead seperated vapors pass to the bottom of a fractionating column called the "low fractionator" since it operates under lowest temperature.

Six tank type agitators used in chemical treatment of gasoline and kerosene

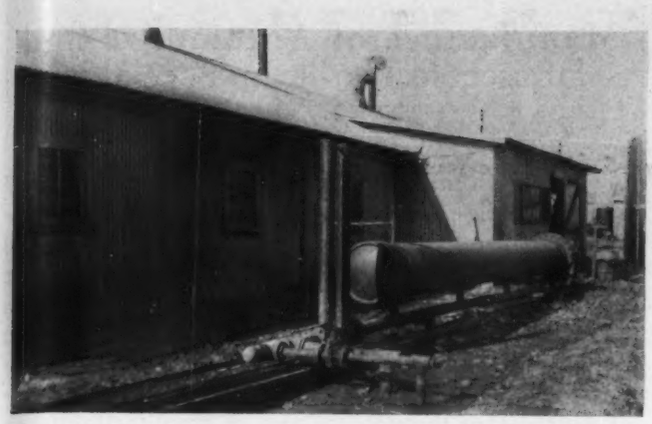
Gasoline vapors from the low fractionator condense to the lightest fraction recovered, ranging from 60 to 70 gravity, depending upon the operating temperature of the first retort.

Accumulation and condensation of reflux media is accomplished through a different type of hook-up of equipment than is usually found in the refinery of prevailing designs. Condensation of the reflux is carried out by means of a primary condenser mounted above the towers through which hot water is circulated under rate control. After the vapors pass through the Southwestern type reflux condenser section the condensate and remaining vapors pass downward into a small separator or vaporizer. Here the reflux is accumulated in this separate small tank and is conducted back into the fractionating columns. The regulation to accomplish condensation of the fraction desired for refluxing over the tower from which it was originally derived is accomplished through the use of automatic temperature controllers. The gasoline vapors taken from the smaller separator are conducted through cooling sections of G-R. type in the water cooling tower and condensed, to be subsequently combined with the main gasoline stream from the "high fractionator" which step in the processing will be discussed later.

The partially stripped crude accumulating in the first large vaporizor, and the bottoms accumulating in the "low fractionator" are picked up by the third crude pump, or hot oil pump, and put through two more exchangers where they are heated by interchange with the hot residuum. The crude picked up by this third pump has cooled from 300° to 250° in the evaporator. Passing through the second series of exchangers it is heated to 350°. From the exchangers it is discharged into and through the second pipe still and the temperature increased to 525°.

SALT SETTLING DRUMS

Hot crude from No. 2 still is expanded into the upper section of a combination salt-settler and evaporator. The salt settler is provided with a large vapor line through which about 80 per cent. of the vaporized portion of the crude is conducted to the gas oil fractionator or tower. A Fisher liquid level controller maintains a level in the salt settler-tank about three-fifths full. The salt, due to concentration, drops out to the bottom of this tank and is removed by blowing it out twice on



Horizontal shell type contact clay filter with the outside removable shell mounted on steel wheels and tracks for easier handling

each eight-hour shift. The overflowing crude passes through a four-inch line and into a stripper column where it is flashed with steam and all of the lighter constituents removed. Vapors from the stripper section combine with those traveling from the top of the salt-settler, and pass with them into the gas oil fractionator. The bottoms derived from the stripper column are passed through the exchangers, and in their travel through the two series of interchange devices are cooled to 150°. This fuel oil has a gravity of 26.5 to 29.5, ranges from 410 to 440 initial boiling point with a 280-300 flash and 325-360 fire.

FRACTIONATING EQUIPMENT

Vapors entering the gas oil fractionator column go into the bottom half of the tower which is a reboiler section. The heavy gas oil accumulating in this lower section of the tower is passed out through a line in quantity regulated by a liquid level control device and are taken into the crude line and recirculated through No. 2 pipe still. Vapors pass upward through the reboiler section, passing through the series of fractionating plates in the upper section of the tower where partial condensation occurs, due to the scrubbing and cooling action from the reflux condenser section and small separator which surmount this tower in a manner similar to that described in conjunction with the "low fractionator." The reflux which accumulates in the upper part of the gas oil fractionator is withdrawn through a side line at the bottom of the fractionating compartment into a flashing chamber. Here the gas oil is flashed with a stream of live steam and any light particles so removed are conducted back into the reboiler or lower section of the column. The finished gas oil is removed from the bottom of the flashing pot. Details of construction of the Boner and Shelden flashing or stripper sections and the fractionating columns were discussed in the December, 1928, issue of THE REFINER AND NATURAL GASOLINE MANUFACTURER in an article concerning MacMillan Petroleum Products Corporation's El Dorado refinery. Gas oil produced at the Borger plant has the following specifications. 37/39 A. P. I. gravity; 470/500 initial boiling point; 200/230 flash and 240/260 fire; a cold test of 30 and is light amber color.

All vapors overhead from the gas oil fractionator enter the "high fractionator" which is the source of the second gasoline fraction and the kerosene cut. The vapors enter the bottom of the high fractionator and pass upward through the plates against the descending reflux. This reflux is accumulated by means of the same type of hot water primary condenser and small evaporator system as is employed in the operation of the former two towers. The bottoms accumulating in the lower part of the high fractionator by means of a rate controlled pump into a kerosene flash section and stripped with live steam to initial boiling point and flash and fire specifications. Here the light vapors are flashed off and led back into the bottom of the high fractionator for rectification. Kerosene is removed from the bottom of the small flashing chamber through coolers to storage. It has the following specifications: 390/415 initial boiling point; 530/545 end point; 175/185 flash and 190/210 fire, with gravity ranging from 41.5 to 43.5° A. P. I.

CORROSION PREVENTION

Gasoline vapors pass from the top of the high fractionator through the hot water condensers operating under automatic control for temperature regulation, through the reflux separator and into G-R. sections for primary condensation, then through Southwestern condensers to combine with the light stream of gasoline which is removed from the "low fractionator" as previously mentioned. Gasoline is produced to specification from 53 to 60 gravity in the usual various grades, with a 420 to 430 end point.

Corrosion of plant equipment has been greatly retarded through the injection of alkaline solutions at three points in the system. The first injection of weak caustic solution, using sodium hydroxide, is at the point where the partially heated crude leaves the first pipe still at 300°. The second injection of alkali occurs at the point where the finally heated crude leaves the second pipe still at 525°. The alkali is introduced by means of air pressure at these points and at a point near the top of the "high fractionator" where the main stream of gasoline vapors begins its travel to condensing sections. In addition to this precaution, cast iron vapor lines are used. After more than two years of operation plant equipment shows but little effect of the inroads of corrosive wet hydrogen sulphide. Caustic is employed in just sufficient amounts to render the gasoline streams slightly alkaline. Corrosion troubles, both from sulphur compounds in the crude and hydrogen sulphide gas, are also retarded to a large extent through the operation of the plant at low temperatures. The free use of steam in the fractionating equipment permits the plant to be operated at low temperature and also tends to minimize corrosion, and further, is of distinct value in the chemical refining of the finished products.

CHEMICAL TREATMENT

The lead sulphide treating method is employed in sweetening and securing color stability of the gasoline. After the lead sulphide treatment, the gasoline is pumped to one of three 250-barrel tank type agitators and washed. It is then taken to a second settler and more lead sulphide settled out. All of this treating reagent is saved for re-use. After the second settling and the addition of contact clay the gasoline is pumped

through a horizontal barrel type clay filter and filtered clear. The outer shell of the contact clay filter is mounted on steel wheels and track so that it can be more easily removed for cleaning of the clay cake.

Kerosene produced from the crude average 16 to 18 color, Saybolt, and is sour and corrosive. It is first treated in an agitator with two pounds of acid per barrel. As the kerosene is pumped to the agitator the acid is mixed with it in a series of mixing chambers, and by the time the agitator is charged the kerosene is treated to color. The acid is drawn off and one and one-half to two pounds of Star V. neutral clay per barrel is added and blown until neutral. After this another one-half pound of clay per barrel is added and the kerosene is circulated through horizontal clay filters until clear. This product is then taken to storage as acid treated kerosene. It is either marketed as engine distillate, sour and corrosive, or held in storage for further treatment.

To produce finished kerosene, the acid treated stock is taken to another agitator and treated with previously used Doctor solution while being charged through a series of mixers, as a preliminary treat. After settling, the old or used doctor is drawn off and fresh 33 gravity doctor solution is used. It is blown about four hours to sweetened and non-corrosive stock. After settling another four hours the lead sulphide or black strap is drawn off. One pound of contact clay per barrel is added and mixed, and the batch filtered by circulation to 25 or 30 color, after which it is taken to storage as finished kerosene. No water washes are employed at all in the treatment of the kerosene.

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Manufacture of Automotive and Household Petroleum Specialties

(Continued from page 61)

flowers which may be obtained from the bontanical drug wholesale companies. In making this product the toxic ingredients of the pyrethrum flowers are extracted with kerosene and essential oils as given above. The extraction is best carried out with warm kerosene in a tall vertical tank equipped with a removable screen bottom or basket which may be readily taken out for the removal of the spent flowers. Recirculation of the oil which seeps through the flower layer facilitates the rapid extraction of the toxic material. The amount of flowers indicated above represents the minimum which should be used for a satisfactory spray. As much as one pound of flowers for each gallon of spray oil is employed by some manufacturers. The use of an excess of flowers insures the ability of the spray to kill flies, mosquitos, bedbugs, fleas, ants, roaches and water bugs as well as moths. The spray may also be used as a deodorant for toilets, sinks, drains, dog kennels, etc.

In the manufacture of fly spray it is considered good practice to control the quality of the material by means of some biological test. In this testing a certain amount of the oil is sprayed through the atmosphere of a cage in which there are flys or other insects and the time required for killing them noted. By means of a standardized test of this type the refiner may be certain that he is shipping a product of uniform toxic properties.

In applying fly spray it is important that the hand spray operates in such a way as to produce a fine mist rather than droplets or small streams. If properly applied it will not stain fabrics or wells. The spray described has a pleasant odor and is not objectionable for inside use.

Only a few household specialties have been described, and it may be pointed out that the list of these may be easily extended to include a wide variety of products. The amount of petroleum oil employed in some of the specialties is not great, however the margin of profit is much greater than in the standard lines of refinery products. In view of the present condition of over production and low prices for the usual line of refined goods this is a point of particular interest. Some refiners have adopted the policy of handling only a straight line of oils, feeling that it was more profitable to sell such refined products to small independent specalty manufacturers for use in their products than to compete with them in the open market.

Another advantage to the refiner who engages in the manufacture of household specialties is the beneficial advertising derived from the use of the company's name and brands on the small containers in which the specialty products are dispensed. Thus it is possible that the sale of automotive and household specialties may also increase the gallonage in motor oils and gasoline. The manufacture of lighter fluid for cigarette lighters and spring oil as well as household lubricating oil are instances where the advertising has been of considerable benefit.

NATURAL GASOLINE ASSOCIATION CONVENTION SYMPOSIUM

Natural Gasoline Convention Considers Economic Conditions

TULSA.—Economic conditions and their effect on natural gasoline came in for serious consideration from the eighth annual meeting of the Natural Gasoline Association of America, held here May 21, 22 and 23. This was brought to the front in discussion that followed the paper read the second day by H. C. Charles of Phillips Petroleum Company, "Is Present Gasoline Storage Adequate to Best Serve the Industry?"

Charles dwelt at length on fluctuations in prices of natural gasoline by seasons. He showed how these prices show wider variation than prices of refinery gasolines. Then he brought in the influence more storage might have in these sharp rises and falls in prices. The paper was generally discussed and the viewpoint of the convention was that additional storage facilities might serve a useful purpose in providing natural gasoline when it is most needed and holding it when it is least needed, thus assisting in providing a price structure that will not vary widely and sharply.

Discussion on this paper was led by A. F. Wood, sales manager of the Chestnut & Smith Corporation.

The annual meeting this year brought to completion the research program started three years ago under the direction of Dr. G. G. Brown of the University of Michigan. In beginning his report this year Brown said the object of the program had been to determine what effect natural gasoline has on engine performance. He said the work was about complete. The complete report will be available later in the year as a bulletin of the department of engineering research of the university.

A significant part of the paper read by E. O. Bennett, chief engineer of Marland Companies, was his contention that the time would come when it would be found desirable to use wet casinghead gas as a material for repressuring flush oil fields. This he said would supercede the present practice of extracting natural gasoline, because it has been found that wet gas is effective in washing oil away from the sand in which it is held.

He said, however, that the changes indicated in producing practice would in the end prove more profitable for both the natural gasoline division of the petroleum industry as well as for the producing division.

NEW OFFICIALS

Dr. E. R. Lederer, vice president of Texas Pacific Coal & Oil Company of Fort Worth, was elected president of the association, succeeding H. A. Trower of Phillips Petroleum Company, who had served two years.

Vice presidents are Emby Kaye, superintendent of the natural gasoline department of Skelly Oil Company; A. J. Schlosser, superintendent of the natural gasoline department of Barnsdall Oil Company, and George L. Ratcliffe of General Petroleum Corporation of Los Angeles.

Directors are selected by company members and the companies in turn designate the individual to serve on the directorate. The companies given places on the board of directors include, Texas Pacific Coal & Oil Company, General Petroleum Corporation, Chestnut & Smith, Incorporated, Lone Star Natural Gas Company, Shaffer Oil & Refining Company, Empire Oil & Refining Company, Barnsdall Oil Company, Prairie Oil & Gas Company, Marland Refining Company, Shell Petroleum Corporation, Carter Oil Company, Victor Gasoline Company and Forrest E. Gilmore Company.

Officials and directors were elected the last day of the meeting, following the report of the nominating committee, composed of E. L. Peck, chairman, D. E. Buchanan and F. E. Rice.

The morning of the first day was given over to routine matters. The convention was opened by F. L. Chase of Lone Star Gas Company of Dallas. H. A. Trower, president, gave his annual address. Committee reports were heard and committees appointed.

In the afternoon Emby Kaye of Skelly Oil Company read his paper on fires and explosions. It was discussed by H. M. Coulson of the Sinclair Oil & Gas Company. The general discussion developed many suggestions for preventing fires and explosions by the use of mechanical devices and proper inspection of equipment. A. T. Scherer of Sinclair Oil & Gas Company read his paper on marketing practices. The discussion was led by S. B. Crooks of Empire Oil & Refining Company. Repressuring and its influence on the natural gasoline industry was then presented by E. O. Bennett of Marland Companies.

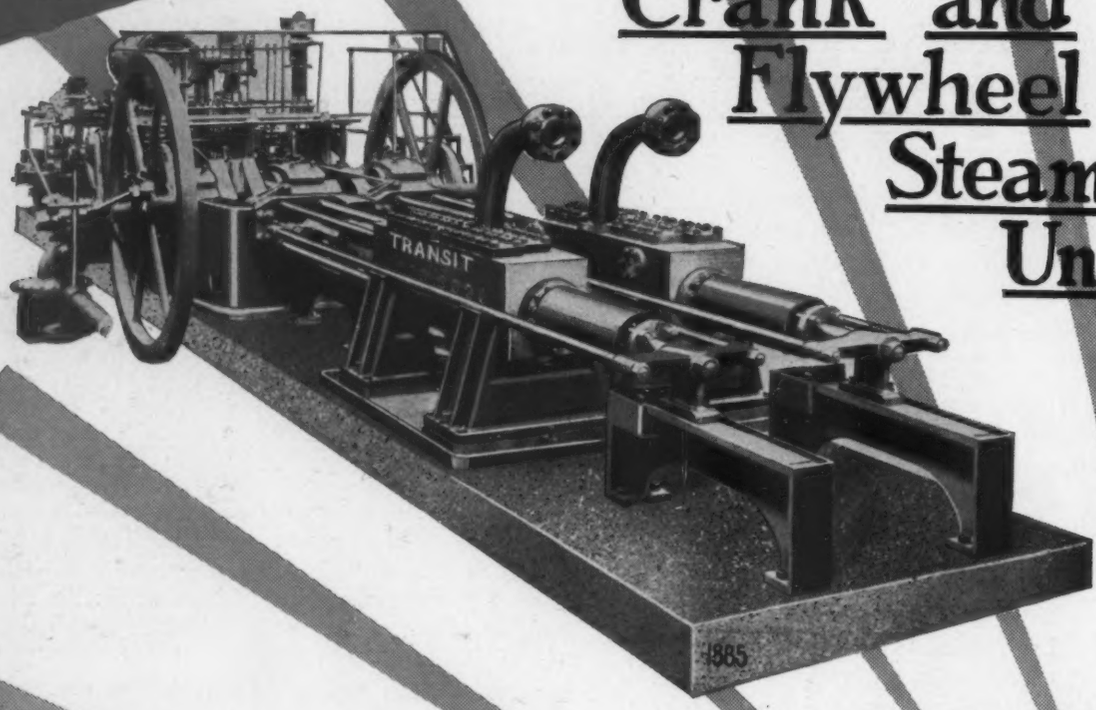
RESEARCH REPORT

All of the second day was given over to the report on the research program by Brown of the University of Michigan, research director of the association. In the morning he presented data on motor fuel volatility as related to engine performance. Vapor pressure as related to vapor lock was the part for the afternoon.

In his introduction, Brown said that total vola-

An Outstanding H

Crank and Flywheel Steam Unit



ECONOMY—The crank and flywheel steam end is by far the most economical in the use of steam; and coupled with this you have the extraordinary reliability, flexibility and safety of steam power—three very important considerations in the handling of dangerously hot oil. Every refiner knows that this is so.

FLEXIBILITY—There is no industry where the manufacturing conditions are changing so rapidly as in oil refining. This requires the utmost flexibility in your pumping equipment.

If the refiner is to keep financially healthy he must be in position to meet these changing conditions. This means flexible equipment. No type of pumping equipment is so flexible as a steam pump. We have reference, of course to TRANSIT Steam Pumps.

UNIFORM FLOW—On this type of pump, the throws on the crankshaft are 90° apart. When one plunger is nearing the end of its stroke (and therefore traveling very slowly) the plunger on the opposite side is at the center of its stroke and traveling at its highest speed. Thus, both the speed and pressure of the oil in the common discharge line are kept very constant. Speed and pressure, thus controlled, in turn, exert a strong influence on maintaining an even temperature of the hot oil as it leaves the tubes.

Hot Oil Pump By TRANSIT

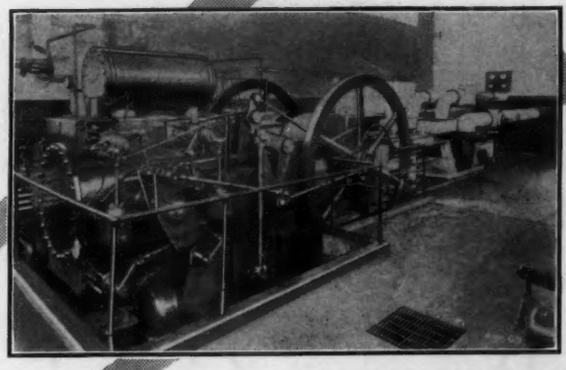
CONTINENTAL OIL CO.

Ordered four—Right off the bat

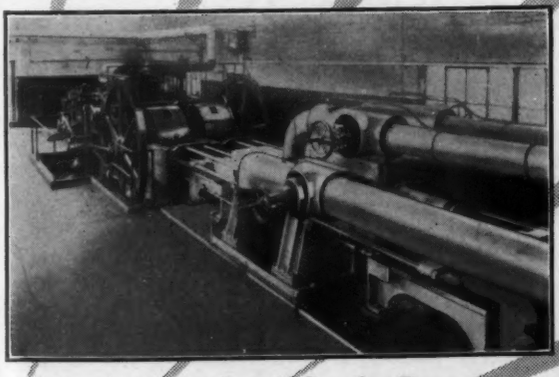
The progressiveness of the West is well exemplified by a recent installation by the Continental Oil Co., of four TRANSIT 15x35x3¾x24" Crank and Flywheel Hot Oil Pumps; one for Sapulpa and three for their Wichita Falls refinery.

At Sapulpa, The Continental needed more hot oil pump capacity in their refinery operations, but they were already short on steam—or boiler capacity.

We were consulted and recommended replacing their direct acting hot oil pumps with pumps of larger capacity, illustrated on the opposite page.



Sapulpa crank and flywheel TRANSIT Hot Oil Pump.



Another view of Sapulpa Pump.

Of course every refiner knows that the crank and flywheel steam end is very economical in the use of steam.

The Continental Oil Company are so well pleased with their installations of TRANSIT Crank and Flywheel Hot Oil Pumps that they have just ordered an additional unit, the fifth.

And we are proud of their installation, if you will permit us to say so, because we believe that they have chosen the outstanding type of hot oil pump developed up to this time.

Agents
BECK-REID SUPPLY CORPORATION
Tulsa, Okla., or any store.

REPUBLIC SUPPLY COMPANY
of California
Los Angeles, California

E. L. WILSON HARDWARE CO.
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NATIONAL TRANSIT PUMP & MACHINE CO. Oil City, Pa.

Agents
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NATURAL GASOLINE ASSOCIATION CONVENTION SYMPOSIUM

tility, or dew point, of a motor fuel had been found to have closer relation to the 90 per cent point than to the end point and that under most conditions partial effective volatility had been found more important than total volatility. The work of the department has been given largely to determining the effective volatility of a motor fuel. He defined effective volatility as:

"The effective volatility of a fuel is the quotient obtained by dividing the per cent by weight of fuel in the mixture delivered to the cylinders by the per cent of fuel in the mixture supplied by the carburetor."

He expressed the opinion that a fuel should have 40 per cent effective volatility if a car is to be driven with use of the choke and 60 per cent effective volatility if the choke is not to be used.

The work of the year led Brown to repeat a statement of three years ago, as follows:

"It seems unnecessary at the present time to recommend more than 50 per cent of natural gasoline in a motor fuel blend, even when the fuel is to be used at temperatures considerably below the freezing point."

He cited instances of satisfactory use of motor fuel, consisting of a blend of 50 per cent natural gasoline in temperatures at and below zero.

VAPOR LOCK

The part of the report dealing with vapor lock brought the conclusion that improvements in automobile fuel feed systems and pressure feed systems will result in satisfactory use of fuels of 12-pound Reid vapor pressure at 100° F. and possibly as high as 15 pounds vapor pressure in cold weather.

A digest of the report made by Brown at the recent meeting is being prepared and will be available for later publication. The result of the three years of research under his direction will be put in book form later in the year and will be available to the personnel of the petroleum industry.

The morning of the third day was the occasion of two papers on storage:

"Is Present Gasoline Storage Adequate to Best Serve the Industry?" by H. C. Charles, Phillips Petroleum Company.

"Gasoline Storage Practice in the Natural Gasoline Industry," by G. M. Davidson of the Empire Oil & Refining Company.

The report of the committee on the president's address was given at this session. This was read by George L. Ratcliffe, chairman. In its conclusion a paragraph of caution concerning the research program was given. With the work of Brown about complete, this committee gave the warning that research efforts of the organization should not be abandoned, since many problems are sure to offer obstacles to the industry.

The final afternoon was devoted to the paper:

"Some Considerations in the Application of Fundamental Analysis to Absorption Tower Operation."

This was presented by W. W. Robinson, Jr., of The Texas Company, who had as co-authors P. S. Magruder, General Petroleum Corporation; J. C. Burks of O. C. Field Gasoline Company, and E. R. Cox of The Texas Company.

The discussion was led by R. O. Campbell of Skelly Oil Company.

G. G. Oberfell of Phillips Petroleum Company read the report of the technical committee of the association. Discussion was led by R. E. Baker of Shell Petroleum Company.

A dance in the evening was the final event of the convention. The dance, as well as all other entertainment, was furnished and arranged by the Natural Gasoline Supply Men's Association.

Is Present Gasoline Storage Capacity Adequate to Best Serve the Industry?

By H. C. CHARLES

Economist, Phillips Petroleum Company

AS THERE are no figures available on total natural gasoline storage capacity, the following discussion is based on natural gasoline statistics as reported by the Bureau of Mines. Also, a few suggestions are offered relative to a storage program and the outlook for the natural gasoline industry.

The chart accompanying this report shows production, shipments and periods in which stocks in the United States were increased or decreased; also, the average price for Grade "AA" natural gasoline in the Oklahoma market.

In 1928, production of natural gasoline increased 9.1 per cent over 1927, while during the three previous years, production increased over 20 per cent above the preceding year. During the first three months of 1929, production increased 18 per cent over the same period of 1928. This large increase for the three months of this year is due to the fact that at the beginning of 1928, production was low and increased gradually during the entire year. If we compare the percentage increase in production for the first three months of this year over the last three months of last year, we find that the increase

The average refiner is selling or storing fuel oil It's a product he can't use He loses money on every barrel he sells It costs him still more on every barrel he stores

Many refiners using the Dubbs Cracking Process are buying fuel oil and profiting by the other fellow's loss

In which group are you?

Universal Oil Products Co
Chicago, Illinois

Dubbs Cracking Process
Owner and Licensor

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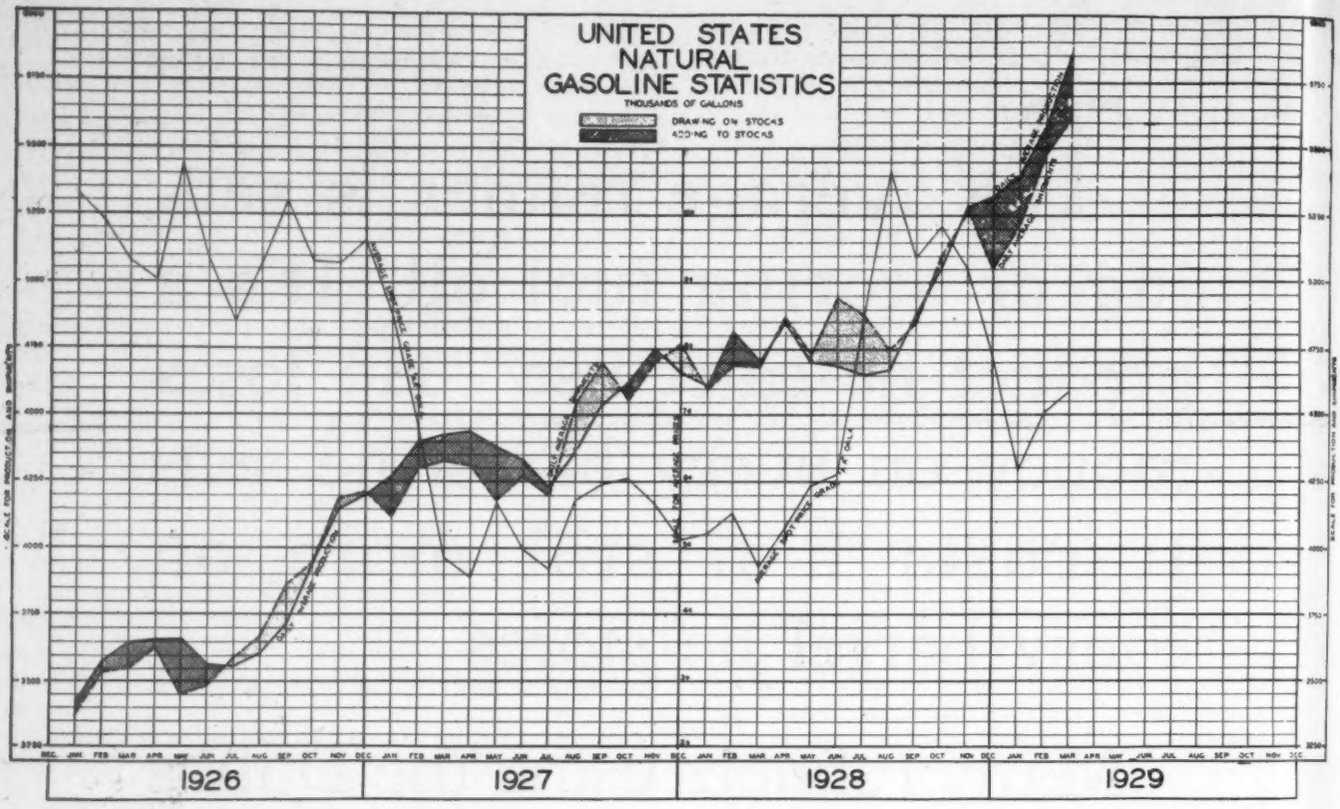

has amounted to only 5.3 per cent. This, however, is a large increase for this period of the year since demand was at its lowest point during this time. The average price for Grade "AA" natural gasoline, however, has held up remarkably well during this period, although there was a large decrease from September of last year to the end of January of this year.

Total consumption of all gasoline in the United States has increased 13.8 per cent for the three months period of this year over the same period of 1928. This is an abnormally large increase in consumption of gasoline and it is not expected that this rate will continue throughout the year, but it seems very probable that we shall have an increase of over 10 per cent in consumption of gasoline in 1929 over 1928. Natural gasoline used by refineries during the first three months of 1929 increased 19.4 per cent over the same period of last year. This may also be an abnormally large increase in the use of natural gasoline at refineries, but we may expect considerable improvement in demand for 1929 over 1928. The largest part of the increase so far this year has occurred on the East Coast and Texas and Louisiana Gulf coasts, and also in California, while Mid-continent and Indiana-Illinois refineries have used nearly 6 per cent less. Shipments of refinery gasoline in the Mid-continent area have not increased at as fast a rate as shipments for the whole country, and it is probable that the reduction in the use of natural gasoline at refineries in this area will show considerable improvements in the next few months when weather conditions are better and demand for refinery gasoline picks up.

SUPPLY BY DAYS

Natural gasoline demand is entirely dependent upon requirements of refineries and the seasonal consumption should vary as much or probably even more than consumption for motor fuel in the United States. This is because refineries build up large stocks of refinery gasoline in the winter and spring which are later reduced when consumption is at its peak. Since stocks of refinery gasoline contain little if any natural gasoline, it appears that natural gasoline manufacturers should prepare for this period of largest consumption. At the end of March, refinery gasoline stocks were equivalent to 44 days' supply, while natural gasoline stocks at plants were equal to seven and a half days' supply. Of course, it would not be necessary for natural gasoline manufacturers to accumulate anything near the number of days' supply in storage that is carried by refineries, but if every plant in the country would double its storage facilities, there should be ample room to absorb the overproduction during the necessary periods. As stocks of natural gasoline at plants reached a new peak at the end of March this year, no doubt, it might appear that stocks are already burdensome, but when it is considered that only seven and a half days' supply is on hand, it does not seem that they are excessive. An encouraging feature concerning stocks at the end of March, as reported by the Bureau of Mines, was the fact that

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in Texas

Texas Refineries with a refining capacity of 550,000 barrels per day have been large users of "Homestead" Valves for the past ten years.

The cast steel straight-way valve shown was especially designed for handling hot oil at temperatures up to 750° and pressures to 300 pounds. Also made in three-way type for use on heat exchangers.

Cooling fins radiate heat and prevent packing from drying. Special taper on plug assures ease of operation under high temperature and pressure.

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Norvell-Wilder Hardware Co.
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San Antonio Mach. & Sup. Co.
San Antonio, Texas

Brigga-Weaver Machinery Co.
Dallas, Texas

Smith Separator Company
Tulsa, Okla.

F. W. Heitmann Company
Houston, Texas

Marine Specialty & Mill Supply Co., New Orleans, La.

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one of the largest producing companies included its highly stabilized gasoline in its report. This represents approximately fifty per cent of all of that company's storage of natural gasoline. This gasoline, then, will not necessarily come on the natural gasoline market, as the greater part of it will go directly to aviation and premium motor fuels.

At the end of March, natural gasoline stocks in the United States amounted to 41,800,000 gallons, of which approximately 25 per cent is stabilized gasoline that should not effect the natural gasoline market. This, then, leaves about five and a half days' supply of natural gasoline in storage. On December 31, 1928, natural gasoline stocks amounted to 25,500,000 gallons, which compared to 30,800,000 gallons on hand at the end of December 1927. Although stocks were reduced 5,300,000 gallons in 1928, the average price for Grade "AA" natural gasoline in the Oklahoma market was .62 of a cent below the average price for U. S. Motor gasoline. It would appear, then, that natural gasoline production was not sufficient to meet the current demand during 1928. But still, the average price for natural being under the average price for refinery gasoline clearly shows that the natural gasoline industry should not expect to receive from one cent to two cents per gallon more than the average selling price of U. S. Motor gasoline.

During 1928, in March, the price for Grade "AA" was 4.73 cents per gallon, while in July, this price had advanced until 10.66 cents per gallon was being received. This is a fluctuation of nearly six cents per gallon in a period of six months. During this same time, the average price for U. S. Motor gasoline was advancing from only 6.31 cents to 9.66 cents per gallon, or a variation of slightly over three cents per gallon. The runaway market in natural gasoline, no doubt, was caused by inability of natural gasoline manufacturers to supply refiners with the necessary amount of their product during the period of highest consumption. An agressive storage program should have been carried out in the first part of the year when the average price for natural gasoline was hovering around five cents per gallon, and in this manner, a large quantity would have been taken off the market, at least temporarily. There would have been more available during the summer months, which could have been supplied to the consumer and a more stable price undoubtedly would have been prevalent during the year. In stabilizing the price at around the average price of U. S. Motor fuel, refiners would undoubtly have continued to use more natural gasoline during the winter months and our prices would not have shown such a sudden drop as they did after October of 1928.

SPOT SALES INFLUENCE PRICE

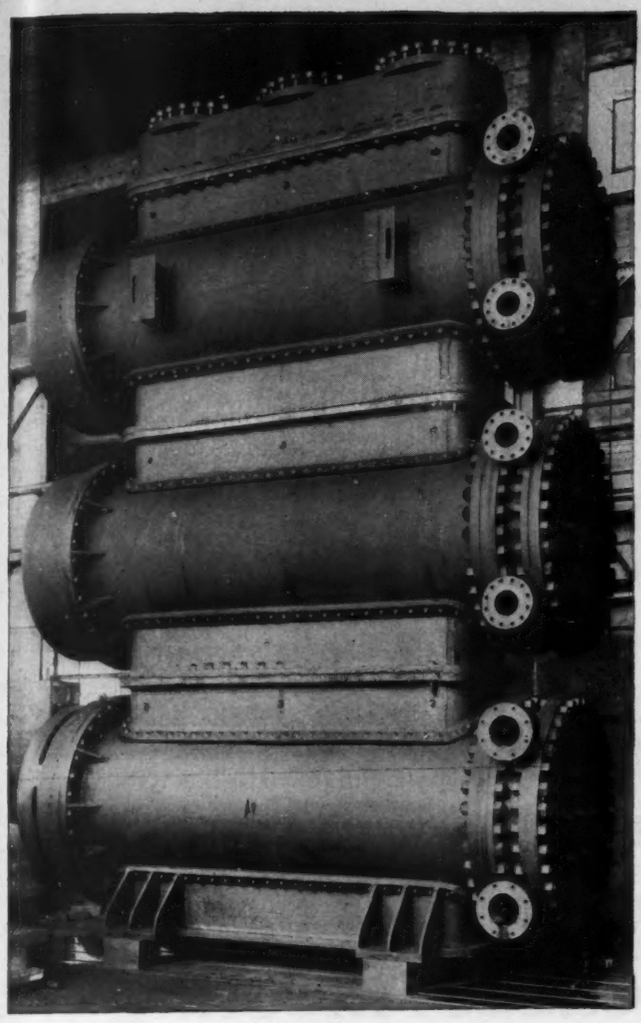
It is estimated that from 80 per cent to 90 per cent of all natural gasoline in the Mid-continent area is sold on contract, and the other 10 per cent to 20 per cent that is available naturally has a big effect on the spot market. The solution of the large fluctuation in natural gasoline market is for plant operators to provide ample storage to take care of the overproduction which only occurs during periods of lowest consumption. When the average price for natural gasoline is very much above the average price of U. S. Motor, refineries use only a minimum amount and in this manner the demand is automatically reduced. Also, when prices are too high, large numbers of small plants are built that increase the supply of natural gasoline. The only way that natural gasoline manufacturers have to stabilize prices is by controlling the outlet to market requirements. This cannot be successfully accomplished by only a few companies, but should be a co-operative movement by the entire natural gasoline industry.

In trying to analyze the natural gasoline situation for the remainder of this year, relative to supply and demand, it is believed that by the time the period of highest consumption for motor fuel is here that demand for natural gasoline will be considerably improved. The best method we have for estimating consumption and probable trend in price of natural gasoline is based upon estimates of total consumption for all gasoline. Past experience has taught that we can make very good estimates on total demand for motor fuel, which, although they may not be absolutely correct from month to month, the errors will compensate and an estimate over a longer period will be nearly correct.

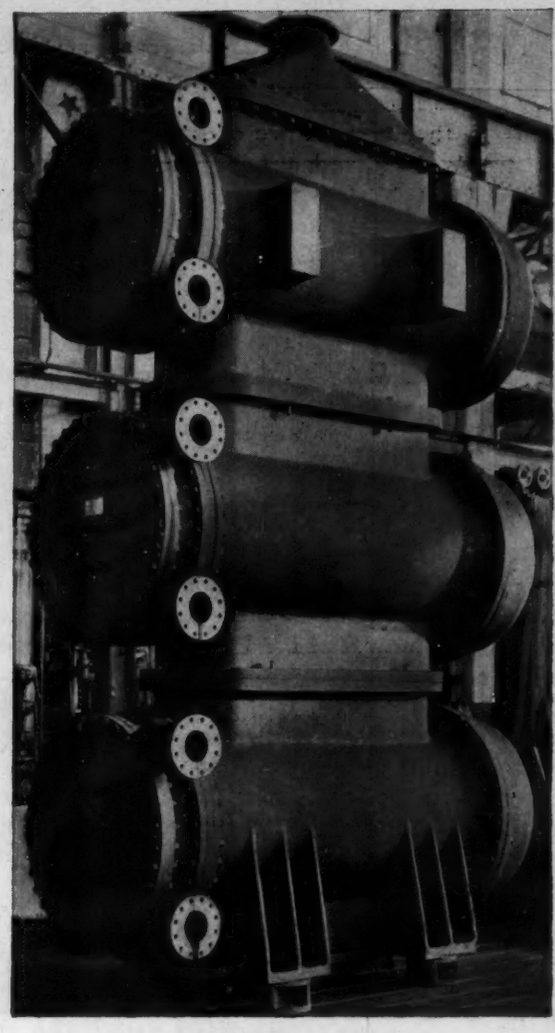
In 1926, natural gasoline production compared to the total consumption of refinery gasoline amounted to 10.58 per cent, while average prices for the entire year show that Grade "AA" natural gasoline was .87 of a cent under that of U.S. Motor gasoline in the Oklahoma market. In 1927, this percentage relationship amounted to 11.31 per cent, and the average price for Grade "AA" was 1.14 cent under the average price for U. S. Motor gasoline. In 1928, the percentage was 11.09 per cent, while the average price of Grade "AA" was only .62 of a cent under the average price of U. S. Motor gasoline. During July and August of last year, this comparison showed that the percentage was the lowest of any time during the year and amounted to 9.1 per cent. It was also during these months that the average price for Grade "AA" was above the average for U. S. Motor fuel. If we have a 10 per cent increase in consumption of all gasoline in the United States in July and August of this year over the same two months of last year, the March rate of natural gasoline production will be equal to only 10 per cent of total consumption of all motor fuel.

INCREASE LIKELY IN CALIFORNIA

Cailfornia is the only state which is likely to increase natural gasoline production between now and July, while there will be a considerable decrease in production on the east coast due to the fact that



VACUUM UNIT
Steel Plate Shells



ATMOSPHERIC UNIT
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(1) Low pressure drop.
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plants in that district are operating along the main gas trunk lines and production there always decreases from 150,000 to 200,000 gallons daily from the winter to summer months. Natural gasoline production in the Mid-continent area is expected to hold about stationary. Although there will be some decline in present producing fields, new situations will be developed to take care of this decline. On the other hand, if California is successful in curtailing crude oil production to the contemplated figure of 650,000 barrels daily, there will not be much increase in natural gasoline production in that state.

In assuming, then, that total demand for all gasoline will show at least a 10 per cent increase over last year, and allowing for a percentage relationship ing natural gasoline production of 10.5 per cent to 11 per cent, it will be necessary to produce over 6,000,000 gallons of natural gasoline daily during the summer months. This, of course, might be accomplished if there is no curtailment in California, but at the present time, it appears that operators there are going to continue with the proration program as contemplated. This indicates that production of natural gasoline will not amount to 6,000,000 gallons daily and that there should be plenty of time to reduce storage at fair prices.

Bureau of Mines figures for March were not available until the first week in May. I would suggest that the Natural Gasoline Association endeavor to collect production, shipments and stocks by wire from the different companies at the end of every week and release these figures as quickly as possible after the first of the following week. If this were done, we would be able to analize the natural gasoline situation with respect to supply and demand immediately. It is impossible to have any one company try to collect statistics as other companies are not willing to give out their information to competitors, but if the Natural Gasoline Association would provide forms to be filled out each week, I believe every company would co-operate and in this manner would be posted on up-to-date activities of the natural gasoline industry at all times.

In conclusion, I do not believe that storage facilities are adequate. The natural gasoline manufacturer should increase his storage capacity so that average prices for natural gasoline would be stabilized and held to approximately the average price of U. S. Motor fuel. If this were done, refiners would then know what to expect, and a maximum amount of natural gasoline would be used at all times.

Procedures and Practices Affecting the Marketing of Natural Gasoline

By A. T. SCHERER
Sinclair Oil & Gas Company, Tulsa

THIS paper is intended to cover in the abstract the procedures and practices of the natural gasoline industry insofar as they affect the marketing of its commodities, and particularly to set out existing policies and practices for the guidance of newcomers. Such features as plant and laboratory control are sketched from a marketing viewpoint, and the writer refers you to publications and other papers dealing in a speecific manner with operating problems.

Deserving of prime mention seems to be the industry's policies with reference to the inception of a plant. Major companies refuse to be governed by the old idea that a plant must be constructed whenever and wherever a quantity of gas becomes available. Better understanding of the marketing of our products has lead to a better understanding of just what constitutes a profitable construction program. Plants are no longer built just to knock a certain percentage of liquid out of a given amount of gas without regard to its quality of marketability. Nor are plants built without the assurance of a continued gas supply commensurate with the investment.

We are ill-advised if we draw up our construction program based upon the current markets of September or March, and just as poorly advised if we base our program upon the markets of 1922 or 1928 or any other year. While markets are discussed at great length in connection with a proposed plant, in my opinion, deserving of more earnest consideration than markets are a multitude of other factors, such as existing and potential gas supply, relative cost per gallon of construction, operation and treating, freight rates, marketing connections, etc. Plants constructed without the proper consideration of the foregoing have kept more of them in the red than so-called low markets.

Haphazard, ill-advised or promiscuous construction programs carry their own hang-over of periodical low markets. Markets based upon the average cost of producing any commodity affected by the law of supply and demand will, over a period, become adjusted to a fair operating level. Human nature, capital and ambition all conspire to either build and operate, or discourage the building of, dismantle and junk the facilities of supply whenever the net back is

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respectively higher than accepted expectancy, or lower than the cost of production.

Good judgment, therefore, dictates that inasmuch as we have available for mathematical determination of factors affecting the cost per gallon of supply, as a guide on one side, and are forced to admit that markets will not exceed a net back over a period of more than a fair return on our most diligent construction operation and marketing efforts on the other side, it may be written that, over a period no plant which is not the result of a combination of thorough study, good judgment and maximum efficiency will survive economically.

UNIFORM PLANT CONTROL

Efficient marketing depends greatly upon uniform plant control. Merchandising our commodities becomes exceedingly more simple and profitable when the plant is so constructed and manned that it may readily, and without loss of production or efficiency, be adjusted to seasonal or over-night atmospheric temperature changes, temporary shortages of gas or water, shut-downs, or conversion from the production of one grade to another.

Without controlled flexibility it appears that flexibility instead of control predominates, and uncontrolled flexibility absorbs a full measure of potential profits. The production of either large or small plants, marketed directly or through outside channels frequently becomes distressed, not by reason of the fact that it is natural gasoline, but more particularly by reason of the fact that it is one or the other of the grades. A seasonal intermission in refinery inquiries and commitments often finds our marketing facilities heavy with one grade while contract requirements and commitments have created a shortage of another. At such times the seasonal price differential becomes out of line. For instance, a temporary healthy demand for Grade "C" brings the price on that grade to a small fraction of a cent under "BB" and "AA" and almost immediately refiners having a preference for the higher recovery grades will revive their inquiries. Within a surprisingly short time the seasonal differential is back into existence. It would seem desirable then to have sufficient flexibility of control to enable us to convert our current production from one to another grade instead of hewing to the line until uneconomical disparity exists between the prices of the various grades. Also, the buyer would be better satisfied and more likely to buy the grade best suited to his particular natural gasoline requirements if he were fairly certain that a differential which exists today would remain substantially the same over 30 to 60 days.

Atmospheric temperatures influence the percentage of light ends which may be recovered, but controlled plant flexibility will do much to overcome the irregularities in the finished gasoline.

LABORATORY CONTROL

I recently made the remark to one of our operators that I remembered the time when laboratory control amounted to checking the residue gases and making a distillation of the finished product, and that the operating department was promptly romped upon with reference to the per cent of gasoline remaining in the tail gases, while the sales department was handed the results of the distillation with the instructions to dispose of the cargo "as is." This operator countered to the effect that I was probably a novice in the business and volunteered that laboratory control in the old days amounted to merely an attempt to determine within a few points of the color, with the hope that it would be somewhere around 20-22, and an attempt to determine the end point of the product within 50-75° of correct. After this was done, he advised, the only remaining interest of the laboratory was to determine how much of the finished product could be captured and held under the existing regulations in a Class 4 insulated car.

Laboratory control now amounts to a thorough familiarity with components of raw gas, the make-up and break-down of the absorption mediums, the exact reaction of all contacts in, through and beyond the plant, and a chemical understanding of the finished gasoline. However, the above enumerated performances cover only the high spots, the low spots comprising research in the field of potential by-products, new markets for materials of present specifications and new specifications for the demand of present markets. The efficient laboratory exerts an effort toward the reduction of both the handling and treating losses and handling and treating costs, and adds generally to the efficient operation of the plant.

The operator who once felt that the laboratory was merely for the purpose of checking the results of his operations now finds his operations predicated on the results obtained in the laboratory, and finds therein a means of recovering the suspended fractions of a cent per gallon otherwise destined to remain lost.

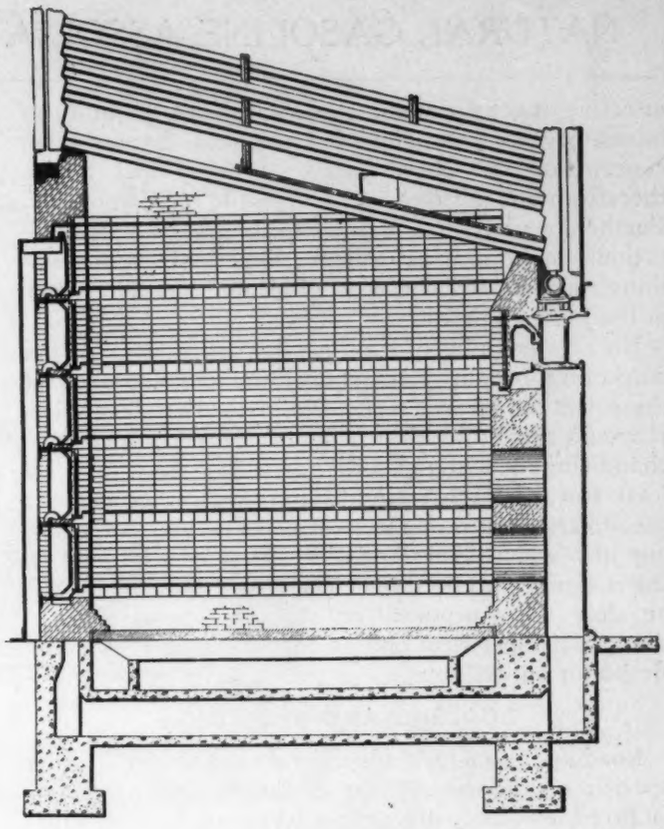
IMPORTANCE OF LABORATORY

The sales departments of today would find their product practically worthless, and I believe it would be impossible to sell natural gasoline without some additional guarantee as to the specifications. Commitments of quantities of specific grades over extended periods are frequently made to be shipped from one particular plant or field. Responsibility therefore falls upon the laboratory to check and anticipate factors which affect the specifications of the finished product of the plant in order that the production therefrom will remain constant and uniform regardless of unexpected changes in atmospheric conditions and storage and plant facilities, as well as possible changes in the character of the raw gas supply. In some fields where the original gas production came from a shallow, or deep sand, and wells are later deepened or plugged back, the constituents of the raw gas may change considerably, and necessitate changes in operation and treating procedures.

Upon the efficiency and effectiveness of laboratory control often depends the difference between a profit and loss figure on the financial statement.

Our natural gasoline association has been a most

Oil firing means punishment *—but not to a Detrick Wall*



In an oil-fired furnace the high rate of combustion causes high furnace temperatures. Solid or ordinary air-cooled walls are a constant source of maintenance and for this reason often restrict the boiler capacity.

Detrick Air-Cooled Walls are supported in sections so that there can be no accumulated load at the base of the wall. This postpones repairs. The cast iron hanger bars which support the sections of refractory act as "fins" in transmitting the heat to the air lanes. This prolongs the life of the refractory.

Detrick Walls are now in operation in oil-fired furnaces of many types. They are standing up satisfactorily under severe conditions. In many cases they have out-lasted three and four times the ordinary walls they replaced and thereby proved the slogan, "Better than the refractory of which it is made."

And Detrick Walls can be quickly and cheaply repaired. Only those sections in the burned area need be replaced. The other sections are supported independently and will not be weakened during the repair.

What is true in oil-fired power plants holds *more* than good in today's big topping stills and cracking units. Detrick Walls hold up under even this unusual punishment, meeting repeated extremes of expansion and contraction without sagging, bulging or failure. With the steelwork of the still already affording the necessary structural base, the addition of a Detrick Wall is too easy, economical and permanently satisfactory to postpone.

M. H. DETRICK COMPANY
140 South Dearborn Street, Chicago
New York—50 Church St.
Detroit—Murphy Bldg.
Pittsburgh—Empire Bldg.
San Francisco—Russ Bldg.

Detrick Still Roofs almost "last a lifetime." Their cost is low and their extreme simplicity makes installation easy. Hundreds are giving service today.

DETRICK ARCHES & WALLS

"Better than the Refractory of which They are Made"

NATURAL GASOLINE ASSOCIATION CONVENTION SYMPOSIUM

effective means toward the attainment of uniform laboratory control. The association has been able to concentrate the observations of many and devise therefrom one uniform and acceptable method of test. Further, we have standardized our grades to specifications incorporating observations and determinations representing the most desirable characteristics in the finished product.

No acts have been of so much consequence in the marketing of our products as the development of these testing methods and the institution of grades. It would seem, therefore, that continued proper merchandising depends greatly upon our continued efforts toward further simplifying and perfecting our specifications and methods of testing; and determining just which characteristics are most desirable to the consumer in the finished product. We should not be slow to incorporate or eliminate from time to time, such specifications as may be determined desirable or superfluous.

LOADING AND SHIPPING

Loading procedure depends almost entirely upon specific conditions such as grade of gasoline manufactured, available storage in terms of daily production, atmospheric conditions, and the requirements of the sales department. These and various other local conditions make loading and loading procedure matters of daily determination and policy.

Various loading procedures have come in for serious study due to the fact that losses sustained transferring the commodity from the tanks to the tank cars were frequently exceedingly high and out of proportion with the operator's idea of what a normal loss should be. In an attempt to recover these losses, recovery plants and various types of dome covers and loading devices have heretofore been a major problem, meriting papers and much discussion by members of the association in previous conventions, but at this time, since such a greater percentage of our production is rectified gasoline the importance of the topic of loading losses has been somewhat minimized. Natural gasoline properly and efficiently rectified loads with a very small percentage of loss, and loading becomes more of a function than a problem.

Shipping is a science and the traffic manager who can keep a substantial loaded mileage credit on his company's equipment, expedite loaded movements through to destination, quickly and effectively accomplish diversions, and keep plenty of empties on hand, becomes a part of the sales personnel and policy, and upon his efficiency in handling loaded and empty equipment, shipping papers, return ladings, et cetera, depends the weakness or strength of the sales department's pledge to service to its clientele.

OUTAGES N TRANSIT

Outage in transit has also commanded its share of the attention of operators for years but for the same reasons set out above our losses in transit have been considerably reduced. As recently as three years ago, 10 to 14 inches out of the car upon arrival at destination were not uncommon, and particularly during certain seasons of the year, or upon movements to points where relatively higher atmospheric temperatures prevailed. Some operators in our industry advise that they have observed that outages in transit amount to a greater percentage of the total contents of the car during early Spring and late Fall, and volunteered the opinion that during these seasons the wide range between the daylight and night-time temperatures causes breathing and accordingly greater outages than during extremely hot weather when temperatures show a lesser variation between daytime and night-time. Our own company records do not disclose any marked rule by which we may be guided in allowing outage deductions. In fact it seems that as a rule irregularity rather than regularity predominates. We have noted that two cars, loaded out of the same stock, moved from the same origin, in cars of supposedly the same physical condition, have arrived at destination, simultaneously, one shell full and the other with several inches out. Our own records over several years on cars rolling from various origins to various destinations disclose the existence of extreme irregularity but happily also indicate a decided trend toward lower outages. Our transit losses have been decreasing yearly for the past three or four years, and we expect this year to show a greater percentage of decline than previously. Many factors enter into this,—refiners have greatly improved their unloading facilities, proportionately less low recovery material is being shipped; and the loading men have been trained not only how to load but also how to maintain the maximum load to destination, by closely checking the condition of cars and safety valves.

PATENTED DEVICES HELP

Patented dome covers and safety valves, et cetera, so constructed as to simplify loading operations and minimize losses of time, labor and commodity are available and desirable. However the efficiency of such devices depends upon the specific operating conditions at the plant, such as characteristics and grade of gasoline produced, loading facilities and other conditions. Each manufacturer should determine the desirability of this added equipment and keep his tank cars in such repair and his equipment so regulated as to reduce possibilities of excessive outage, bad-order throw-outs, in-transit repairs, etc.

It is the policy of the industry to allow all outage. This guarantee of quantity at destination is qualified however upon proper and prompt handling by consignee. If for reasons not due to the acts of the shipper, a car is held under-load by consignee for a period longer than 24 hours before gauging, the consignee should absorb such outage as appears in excess of normal outage based upon gauges of other cars handled promptly and under similar atmospheric and physical conditions.

In many instances cars so held beyond the 24-hour

all-around economy

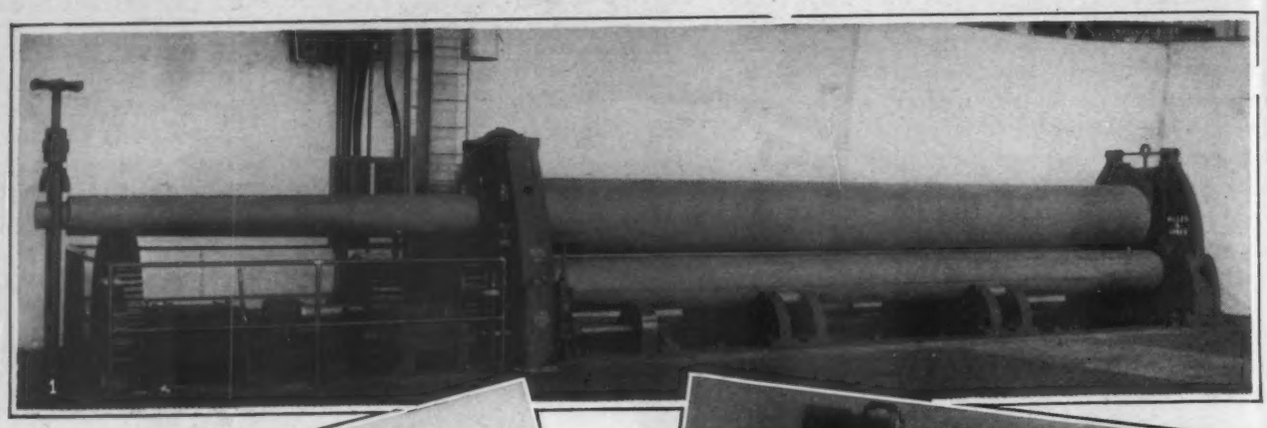
In drilling hundreds of wells with the CLARK Senior Drilling Engine it has been thoroughly proven that the efficiency and durability of this engine enable operators and contractors to *take advantage of every possible drilling economy*.

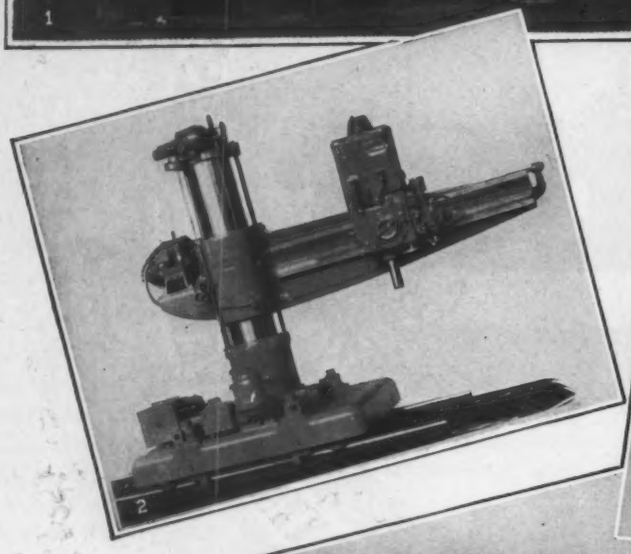
Get detailed information. Clark Bros. Company, Olean, N. Y. Export Offices: 150 Broadway, N. Y C. Branches and Warehoues: 125 W. First St., Tulsa; McCamey and Sweetwater, Texas; Artesia, N.M. California: Smith, Booth, Usher Company, 228 S. Central Ave., Los Angeles, and 50 Fremont St., San Francisco.

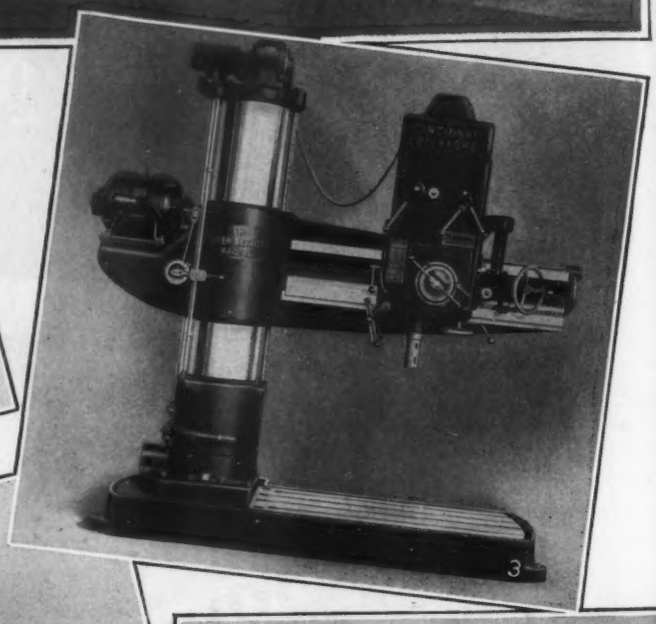
Clark Bros. Co. Olean N. Y.

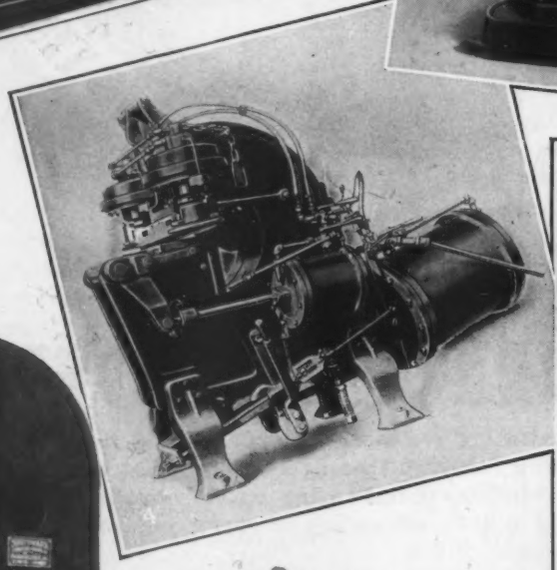
Compressors and Gas Engines

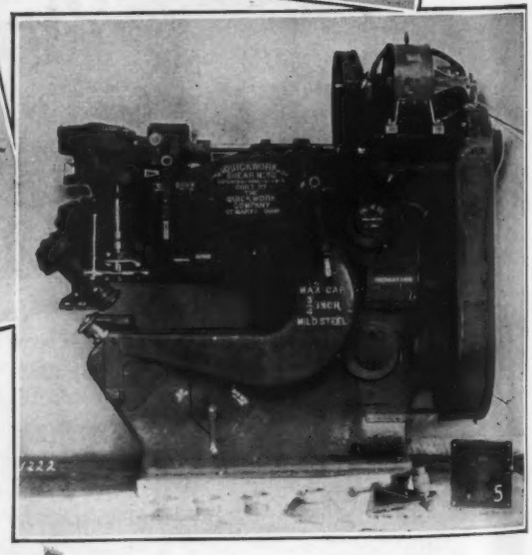
CLARK

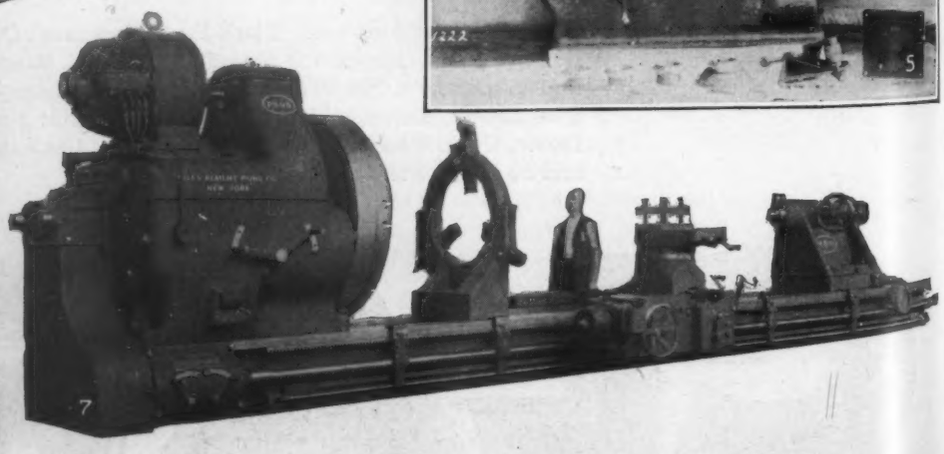


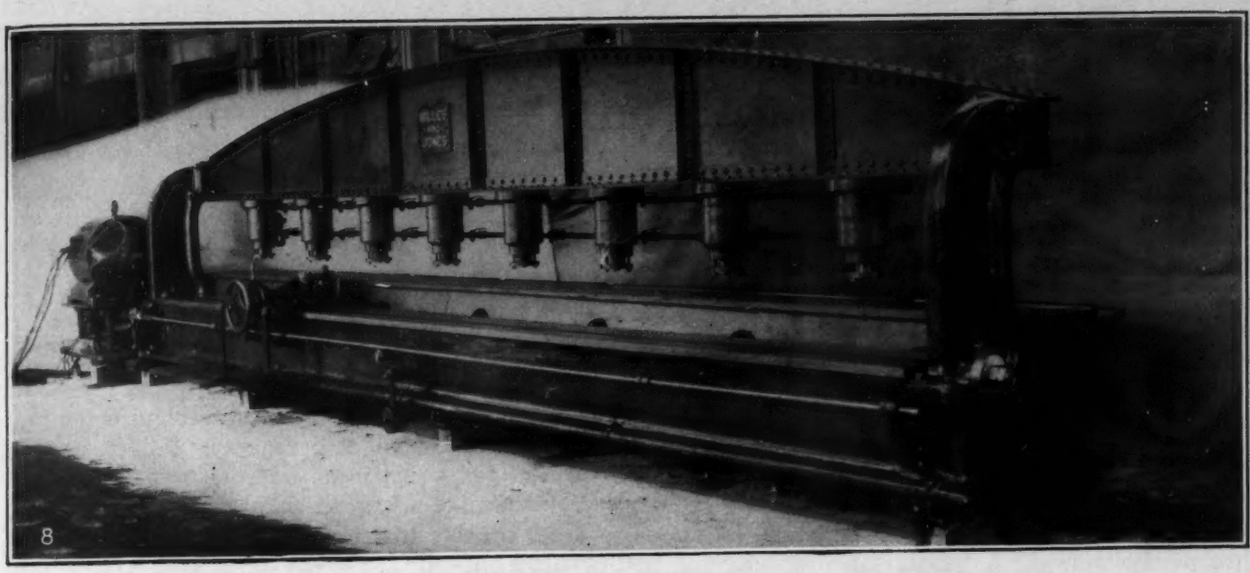












1—Hilles & Jones 20′ Rolls for 1½″ Plates.

2—Cincinnati - Bickford Super - Service Radial Drill—8′ Arm.

3—Cincinnati - Bickford 7′ Radial Drill

4—McCabe Flanging Press ¾″ Cold Steel Plate capacity.

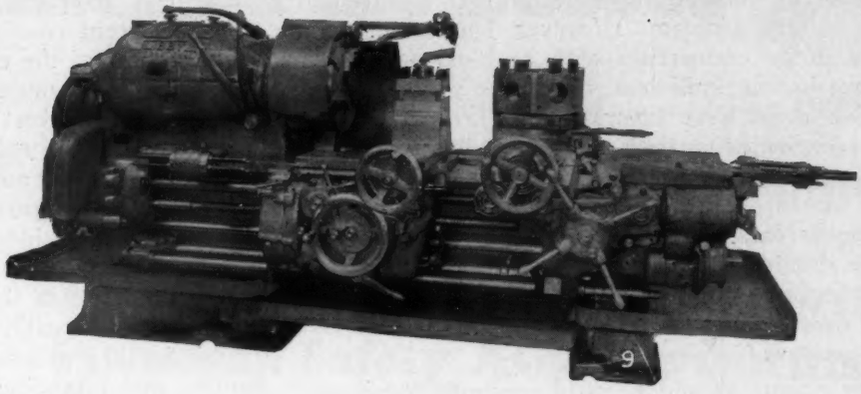
5—Quick Work Rotary Shear.

6—Southwark 150 Tons Crimping Press.

7—Niles - Bement - Pond 60″ Lathe with 20′ Gap.

8—Hilles & Jones 30′ Planers.

9—Libby Turret Lathe.



A special department in the new J. P. Devine Manufacturing Company's plant at Mt. Vernon is devoted exclusively to the service of the oil refining industry.

When construction, which is going forward at top speed, has been completed and the new equipment is installed, the oil refining industry will have one department, in itself a complete plant, entirely at its disposal.

The growing demands which the industry is making upon us dictated the policy. Notable additions have been made to our staff and every piece of equipment going into the plant is of the most modern design. It has been a complete retooling throughout.

The net advantage to the industry will be a general raising of a standard of service which for years has been winning and holding the confidence of the oil refining field.

J. P. DEVINE MANUFACTURING COMPANY, Inc.

MAIN OFFICE, BUFFALO, N. Y.

Plants: BUFFALO, N. Y. AND MT. VERNON, ILL.

New York Office
51 EAST 42ND STREET

Chicago Office
122 SOUTH MICHIGAN AVE.

NATURAL GASOLINE ASSOCIATION CONVENTION SYMPOSIUM

gauging period allowed are likewise not unloaded within the 48-hour unloading period, the detention of equipment therefore causing the shipper further loss. In some instances this loss is negligible, amounting only to the loss of potential mileage earnings, however instances are frequent when car detention at several destinations simultaneously forces the manufacturer to rent cars at a high-trip rate to immediately relieve storage. The storage facilities of the natural gasoline industry are pitifully inadequate, particularly in districts where large flush production exists. This is due probably to the fact that it is not economically advisable to erect pressure storage to handle an immediate production which is not certain to be maintained over a period. A paper is being delivered in this connection dealing specifically and admirably with the storage problem. However, I mention storage here in its connection with tank-car facilities. Plants not having sufficient storage to protect their production must have insurance in form of excess tank car facilities against probable delay due to transit irregularities, longer than average hauls, or possible forced detention by consignee. Where consignee holds cars, for any reason, in excess of 48 hours he should notify shipper and arrange to have outage checked within 24 hours and accept the liability of damage or expense to shipper occasioned by delayed return of equipment.

Outage claims should be paid promptly upon receipt, less 1%, or net, depending upon the terms of the sale. The practice and policy of the industry is to allow a claim by consignee covering the difference between the quantity billed and the quantity received, corrected to 60° Fahrenheit and freight paid by consignee on the amount received at 60° F., less than the car capacity.

SPECIFICATIONS AND OFF-SPECIFICATION CLAIMS

Specifications are also guaranteed at destination. Any difference of barometric pressure, atmospheric temperatures, etc., existing at destination must be allowed for at origin since the commodity *is* guaranteed *at destination.* Many independent laboratories and services are available to both parties if the necessity for joint inspection develops.

It is preferable, however, to have your own laboratory attendants make the check test with the consignee's chemist. Any irregularity of either's equipment or methods thereby becomes observed and a repetition of the error avoided.

Frequently the error develops into a matter of only the difference in human element in procedure or readings and is easily arbitrated.

Under our present regulations of distillation procedure, a difference of 30-50° in the end point is possible by the use of the electric heater instead of the gas flame. Such differences are not easily adjusted and no settlement can be made entirely satisfactory to both parties.

This condition merits the immediate and serious attention of our association and my previous plea for further simplification and revision of test methods and specifications is repeated here.

The adjusting of off-specification claims is a matter of specific occurrence. Each claim must be handled upon its own merits. An off-color or off-doctor car at the unloading rack may represent a complete loss to the consignee not having facilities for re-running or treating same, whereas the second consignee may either have such facilities or be using such a small percentage of naturals that he could absorb the car at negligible loss. In fact, so many different conditions exist that each off-specification claim is a matter of the moment and said claim must be handled as a separate and specific adjustment, subject to current conditions, operations, facilities and requirements of the consignee.

Primarily we must remember that while it may seem easier to divert the car, such action may seriously damage the refiner whose immediate requirements are thereby not served, and whose position as a consumer of naturals may be hazarded. Reliable shippers will consider the refiner's requirements and be governed accordingly in the settlement of claims or the diversion of the material. We have found reliable and responsible buyers of naturals to be equally fair in their treatment of us and we feel that an honest understanding of each others problems and operating conditions is the greatest single factor contributing to satisfactory adjustments.

MARKETING

To me marketing is figuratively "The End of the Rope." A leader in our industry said in discussion about a year ago "our marketing practices are the laughing stock of the country."

This man must have felt that there was room for improvement in our marketing practices, and I believe we are all in accord there. No doubt there always will be room for improvement and hesitating to adopt apparently constructive policies that later need to be revised is neither progressive nor educational. Experiencing the result of a poor policy at least broadens our capacity for determining a better policy.

However, I believe and am willing to go on record as considering our marketing practices and policies as subordinate to our operating practices and policies. If marketing is the "End of our Rope" producing is the rope and little can be at the end of a poor rope.

Our marketing problems, meriting as they do our sincere study and severe application will remain unsolved so long as our production continues in excess of our current and prospective consumption requirements. Seasonal over-production of our products is profitable and necessary but yearly over-production is disastrous. Storage is necessary and reserves are essential but no marketing practice can be instituted which will survive a production in excess of current

PULMOSAN SAFETY EQUIPMENT

$18,367,435.00 Refinery Fire Losses!

That was the actual loss in dollars and cents from 1922 to 1926 (as reported by the National Board of Underwriters). *Over 18 million dollars burned up* . . . needless and *preventable* waste!

Fight Fire Losses in Your Plant with PULMOSAN Safety Asbestos Outfits!

Oil fires are put out quickly . . . if your workmen are protected with PULMOSAN outfits. Repairs quickly effected . . . fuel saved . . . burns and bad accidents eliminated.

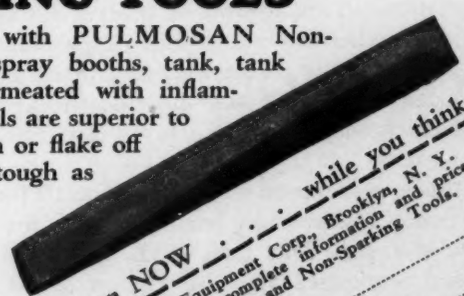
PULMOSAN outfits represent the "last word" in extreme freedom, maximum heat insulation, and great durability. Their cost is negligible in view of the great service rendered in an emergency. Keep enough of them on hand for immediate use. Prevent the possibility of enormous loss in *your* plant.

***Note:* A complete descriptive circular is available on PULMOSAN helmets, suits, overshoes, mittens and gloves. The coupon brings full information and prices.**

Furnished in all styles: hammers, chisels, scrapers, screwdrivers, wrenches, etc. Standard makes—or made to specification. Send coupon for information.

NON-SPARKING TOOLS

Guard against fire calamity with PULMOSAN Non-Sparking tools . . . in your spray booths, tank, tank cars, and other enclosures permeated with inflammable fumes! PULMOSAN tools are superior to brass or copper; will not squash or flake off . . . in fact they're almost as tough as steel!



PULMOSAN SAFETY EQUIPMENT CORPORATION
384 Jay Street Brooklyn, N. Y.

Mail the Coupon NOW . . . while you think of it!

PULMOSAN Safety Equipment Corp., Brooklyn, N. Y.
Gentlemen: Send us complete information and prices on your Asbestos Safety Outfits and Non-Sparking Tools.

R

NATURAL GASOLINE ASSOCIATION CONVENTION SYMPOSIUM

and prospective consumption plus seasonal storage and protective reserves.

My idea of an economic monstrosity is an industry which over a period expects to be able to market its commodity in such a manner as to continue in a good financial position while maintaining supply in excess of demand.

MERCHANDISING

But I am not evading the issue of *proper* marketing, I am merely qualifying the word "proper," feeling as I do that marketing at a loss, while not "proper" is frequently efficient marketing and darn good selling, considering the existence of an over-supply for which there is no demand. We have frequently heard the remark that "price is no object, the stuff isn't moving." What folly then to suppose that *proper marketing* can overcome improper regard for the old law of supply and demand.

Proper marketing is merchandising. Therefore, merchandise your commodity and follow the old precept of "Doing Unto Others as you Would Have Them Do Unto You." If it comes to drawing up a code which merely recites a list of acts that you do not wish to do unto others and do not wish to have others do unto you, an agreement can be reached as to which acts are admittedly unfair, then a Code is good. If each company, however, can unqualifiedly say that they are not engaging in any practice of marketing to which they would object to in others, and if their practices are showing up to the credit of the industry in which they operate and to the satisfaction of stockholders and executives of vision, they are *merchandising.* On the contrary, when the manufacturer throws material into an unreceptive market, trying to beat the gun of weakening tendencies, and engages in unethical practices, he not only is sacrificing the industry to his immediate advantage but also to his own permanent loss.

Proper merchandising is a coordination of—

Wise Construction Programs
Flexible Plant Control
Efficient Laboratory Control.
Service to Suit the Consumer, and
Proper Marketing.

Natural Gasoline Storage Practice

By G. M. DAVIDSON
Empire Oil & Refining Company

JUDGING by the standard of modern natural gasoline plant design, more thought might be given storage facilities.

The storage problem for a plant can be presented under the following headings:

1. Amount of storage capacity required.
2. Safety of the installation.
3. Most economical type of storage tanks.
4. Gauging devices, piping, fittings, etc.

When the plant product is shipped by rail, experience from the manufacturing point of view indicates that storage should be provided for 30 days production to allow for minor irregularities in shipping schedules and transportation. This amount of reserve storage is hardly sufficient when several grades of gasoline are being made. Presumably plants with contracted outlets by pipe line deliveries need only provide storage for gauging and emergency interruptions of pipe line service.

There is almost a universal adoption of the 10 feet by 40 feet—50 pound test pressure horizontal tank for natural gasoline storage. This tank is about as large as can be utilized economically. Size 11 feet by 42 feet tanks have been tried but are more difficult to transport, handle and install and are subject to considerable distortion when filled. The 10 foot by 40 feet tank has come into such common usage in the Mid-continent that fabricators generally carry steel for the heads and shell in stock. The shell is generally ¼-inch plate, the heads are 5/16-inch or ⅜-inch dished to a radius equal to the diameter of the tank. The shell is made up in five rings. The tanks are built to withstand a hydrostatic test of 50 or 60 pounds per square inch and relief valves are set for working pressures of 20 to 25 pounds per square inch. Apparently there is a big difference in opinion in the type of joints used in fabricating these tanks. Some companies specify a riveted and caulked joint. Others are depending upon a double weld lap joint and some use a combination of both. Tanks of this size are subject to distortion both in the shell and heads. Breathing of the tanks has been the source of cracking welds, and in some instances head have parted from the shell completely. Riveting and caulking are subject to leakage due to the flexing of the tank. Rivets must be tightened and joints recaulked whenever the tank is moved. The welding art has made some wonderful strides and there is no reason, excepting the possible lack of experience and conscientiousness of the fabricator, why welding should not be used. In a combination of riveting and welding of plates used in these tanks, it is doubtful if the riveting serves for any but a safety factor n the event of a weld failure.

MOVING TANKS

A tank such as described above is awkward equipment to transport. Hauling contractors are generally

VAPOR PHASE REFINING

Our licensees, in more than thirty refineries, are proving the validity of our claims to their own satisfaction and profit.

You too can decrease your treating losses and improve the quality of your cracked gasoline—at the same time reducing your costs.

Vapor phase cracked products, as well as pressure distillates, are being successfully refined.

The Gray Processes Corporation

961 Frelinghuysen Avenue
Newark, New Jersey

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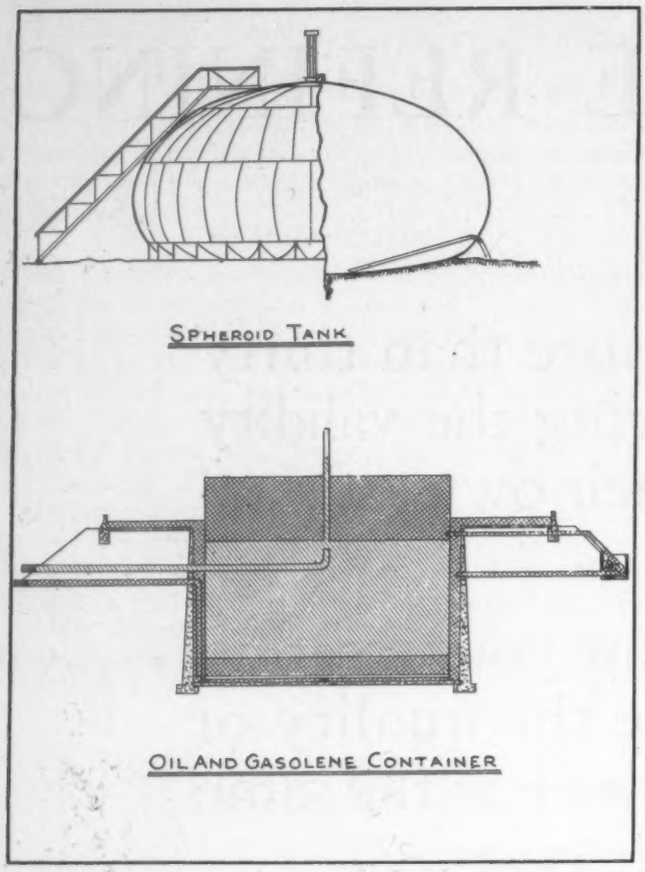


SPHEROID TANK

OIL AND GASOLENE CONTAINER

in demand when a plant is building in a new oil field and these tanks are not generally handled as they should be. The tank in being rolled into position will often be supported on projections from the shell such as a manhole. Manholes are necessary for fabrication and internal inspection. The boiler type manhole is to be preferred and the tank should be shipped with the yokes and cover inside the tank. Slow delivery generally eliminates this type of manhole. To overcome the objection of putting a projection on the shell some companies put the round external type manhole in the head. An inside and outside gas well is recommended for this joint.

Piping flanges are provided for relief valves and connections for filling, emptying, water drainage, and collecting of vapors. As a rule the tanks are gauged with the use of gauge glasses. Care should be exercised to see that the collars welded in for this purpose are horizontal. They should be located on the tank itself and spaced so as to provide for a standard length gauge glass. Accurate gauges are difficult to obtain when the gasoline in the tank is unstable. Bubbles forming in the gauge glass will vary the apparent liquid level. In an attempt to eliminate this difficulty some companies have used gauge glasses on a vertical pipe which was connected to the bottom and top of the tank. Gauges with such an arrangement are often in error. Floats and measuring tapes have been tried but seem to be unreliable. One of the best forms of tank gauging devices is a tube projecting through a packing gland at the top of the tank. A pet cock at the top is opened when gauging and the liquid level is noted when the bottom of the tube is at the liquid surface, noted when gasoline flows from the valve. For convenience two tubes are used, one measuring the upper five feet of the tank, the other the lower five feet.

Manufacturers of these tanks suggest five supports in setting such tanks. In general only four are used, and where there is even bearing, that number will serve satisfactorily. Supports are usually made of concrete about 12-inches thick and extend one-fourth to one-third the circumference of the tank. Due to the possibilities of corrosion and to take up minor unevenness of bearing several sheets of tar paper should be used between the support and the tank. Steel saddles can be used which fit the periphery of the tank and rest upon a level pier. Tanks generally out last the plant and these saddles have the merit of reclaim value.

The tanks should be given a coat of metal preserving paint which, if put on at the shop, should be specified as to kind and manner of application. The tanks should be given a final coat of paint which will reflect heat.

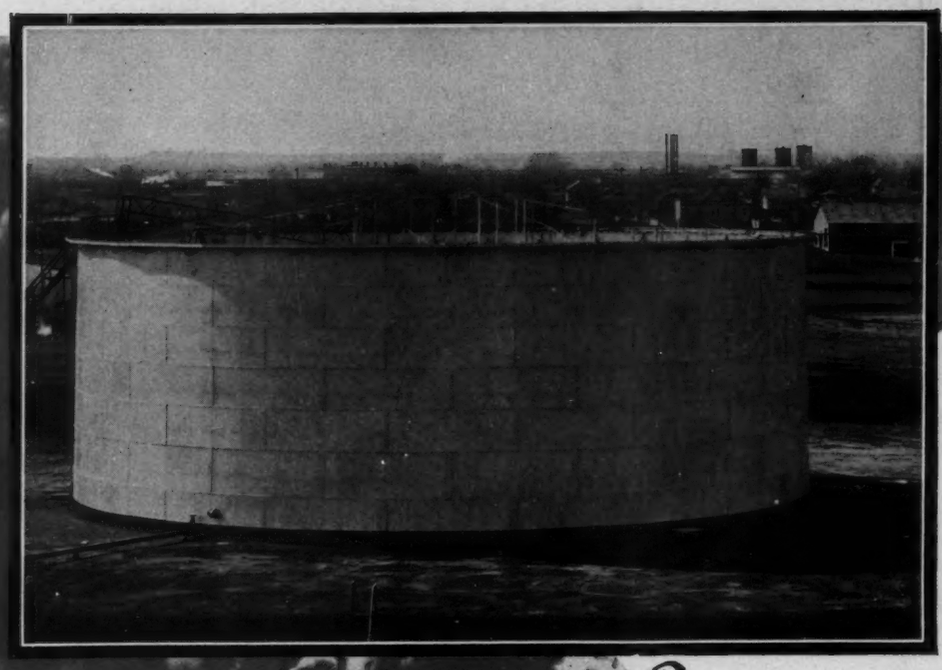
Insulation has been tried on such tanks and found to have a material effect in reducing losses. Insulating with hair felt or asbestos is an expensive job. Some manufacturers are covering their storage with earth, which makes an excellent insulator, though great care should be exercised to protect the tanks against corrosion.

It is the practice with a number of companies to correct all tank gauges for temperature. In this connection it should be noted that the temperature changes effecting the volume of the tank content also changes the dimensions of the tank to effect a small correction. This distortion of the tank due to the liquid head is another factor affecting the calculated gauge table.

RECOMMENDATIONS FOR SAFETY

The matter of first consideration is the location of the storage with respect to the plant. It should be removed as far as possible, preferably on a lower level. The joint at the shell and head is the weakest part of the tank and in all probability would be the first to part. For what added time it would mean in case a head joint failed completely it might be advisable to install the tanks so that the contents will not be directed toward the plant nor homes. Fire walls have not been used generally in the Mid-continent but should be considered. Automatic safety gauge cocks have proven worth while in fires.

Relief valves should be given more serious considerations. Relief valves have been provided generally for relieving excess vapor pressure of the contents and for excess pressure due to operation. For these circumstances a two-inch relief valve has served. The destruction and personnel risk in the possibilities of a fire appears to warrant relief valves to meet this situation. The Bureau of Explosives through John F. Fetterly has published a bulletin entitled, "The Determination of the Relief Dimensions for Safety Valves on Containers in which Liquefied Gas is Charged and where



Wiggins Floating Roof on 80,000-barrel tank at a refinery.

Where mixtures of air and oil VAPOR *need only a* SPARK *to start a* FIRE

OIL vapor escaping from an ordinary tank—even when equipped with a so-called gastight roof—mixes with air to form a highly inflammable mixture. Similarly, when such a tank breathes in fresh air at night, a mixture is created inside the tank which needs only a spark to produce a catastrophe.

Wiggins Roofs practically eliminate the formation of such mixtures, either inside or outside the tank. The Wiggins Floating Roof — specially adapted to working tanks—rides directly on the surface of the oil, always effectively separating oil and air. The Wiggins Breather Roof—for standing storage tanks—stops daily breathing by providing for thermal expansion and contraction. This is particularly important when a thunder shower suddenly cools a tank on a hot day. While an ordinary gastight tank sucks in air and creates a highly combustible mixture just when lightning is most prevalent, the Wiggins Roof prevents such action.

Tests conducted by prominent oil companies have shown the effectiveness of Wiggins Roofs in preventing a fire. In actual service, direct lightning strikes have not resulted in fires.

The fire protection afforded by Wiggins Roofs is in addition to the stopping of evaporation loss. Ask for detailed information or estimates.

CHICAGO BRIDGE & IRON WORKS

Dallas	3355 Magnolia Bldg.	Detroit	1520 Lafayette Bldg.
Chicago	2463 Old Colony Bldg.	Philadelphia	1608 Jefferson Bldg.
New York	3102 Hudson Terminal Bldg.	San Francisco	1051 Rialto Bldg.
Cleveland	2234 Union Trust Bldg.	Havana, Cuba	Apartado 2507

STOP FIRE LOSSES *with* WIGGINS ROOFS

RNGM 6-Gray

NATURAL GASOLINE ASSOCIATION CONVENTION SYMPOSIUM

the Exterior Surface of the Container is Exposed to a Temperature of 1200° Fahrenheit."

This formula is given for uninsulated containers as

$$A = \left[\frac{(B \times 3.1416 \times U) \text{ plus } E}{L \times P \times 50}\right] \times C \times (t1 \text{ minus } t3) \sqrt{\frac{W3}{W1}}$$

A = Relief area of the safety valve

D x 3.1416 x N x Sine valve seat angle.

B = Outside diameter of the container in feet.

E = End area of the tank

U = Length of the container in feet

C = Heat transfer in B.T.U per square foot per hour per degree Fahrenheit temperature difference between 1200° F. and the temperature of the container contents when at the pressure at which the safety valve is set to open.

C = t1 minus t3

A

t_1 = Temperature in degrees F. at outside of container.

t_3 = Temperature in degrees F. of contents of the container when at the pressure at which the valve is set to open.

W_3 = Density of steam in pounds per cubic foot at relief pressure.

W_1 = Density of vapors in pounds per cubic foot at relief pressure.

W = The latent heat of vaporization of the liquid portion of gas in B.T.U. per pound weight at relief pressure.

P = Absolute pressure per square inch at which relief pressure valve is set to open.

D = Diameter of safety valve

N = Lift of valve in inches.

A = 62.5 plus 20 T

T = Thickness of steel wall of the container.

Calculations show that two tank car relief valves set at 25 pounds per square inch are necessary to relieve a tank such as we have been considering under the conditions and assumptions made. From a knowledge of the spring characteristics used in these valves, we know the tank will build up to a pressure of about 37 pounds, relieving the tank with a venting area of 32 square inches. The two valves may be connected to the tank with a six-inch pipe, if not too long, and yet the valves should be removed far enough from the tank so that heat from the vapors, if ignited, will not cause adjacent tanks to relieve.

Tanks such as are in general use will not stand any external pressure and vacuum relief valves should be provided. A two-inch check valve generally serves for this purpose, the only precaution necessary is to install one where operation will not be prevented by condensation collecting and freezing at the valves.

The piping should be designed to give some flexibility. Overhead piping is generally more subject to expansion than the piping underground, but consideration must be given to the fact that tanks will settle unevenly. Several fires have occurred from fittings breaking because of pipe strains and more general use should be made of expansion or flexible pipe joints, particularly where more than four or five tanks are put in the same battery.

Probably every company has had some experience in finding a different grade of gasoline in the tank car than in the tank and has traced it to the absorption of lighter hydrocarbons when pressure was put on the tank with residue gas. Air has been used with a risk. Flue gas should serve for this purpose.

LARGER VOLUME STORAGE TANKS

Construction of large containers capable of withstanding pressure has long been a problem confronting structural engineers. One of the obvious ways of designing a larger container is to expand the type of storage now in use. Considerable difficulty is encountered in such a design. Supporting such a type of tank is a problem. If the diameter is large the shell must be stiffened to prevent distortion. There is therefore a definite economic limit to the size of the horizontal cylinder container which we can use.

A pressure container was designed some years ago in the shape of an elevated cylindrical tank with an ellipsoidal bottom and top. The natural evolution from this was the spherical tank. This structure was elevated on columns attached to the sphere at the horizontal equator. Relatively heavy construction was employed in the support and stiffening was necessary in the tank. The bottom of the tank was subjected to the gas pressure and the total head of the liquid. These tanks were generally successful and probably cost was the factor which prevented their more common use. There is no shape which will be entirely free of tendencies toward deformation when subject to the varying stresses of a gas pressure and varying liquid head. However, it is evident that the particular structure which will be most free from tendencies to deform would be approximately the shape taken by the flexible container under the conditions of the combination of gas and liquid loads. The simplest way to illustrate what this shape would be is to fill a rubber balloon with water and place it on a flat surface. It would be seen that the shape taken is that of a spheroid, circular in plan and flattened on the bottom. If a rubber balloon of comparatively thin material is used and the gas pressure is relatively small, the shape will be comparatively large in diameter when compared to height. If the balloon used is of thick rubber and the gas pressure is relatively higher, the form taken is that more nearly a sphere. Such a tank, called the Horton Spheroid has recently been designed. This tank has the least tendency to deform of any shape and the roof and bottom as well as the shell are all used in approximately uniform stress, consequently it is a relatively economical tank to build.

Another pressure container designed by Allen Van Rensselaer is of interest. The container is a vertical steel cylinder and bottomless. A light steel roof is placed in the cylinder some distance above the container. The cylinder is built concentrically within a

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The progress of North American Car Corporation has been steady and rapid principally because it offers in special *freight* cars the same type of service that Mr. Pullman offered in special *passenger* cars. North American Tank, Refrigerator and Palace Poultry Cars are not merely cars but cars of *unusually* advanced design, maintained at an *unusually* high degree of efficiency. In addition to the advantages of ownership, the lessor enjoys the satisfaction of knowing that his products are being shipped (and will continue to be shipped) in more modern and better conditioned cars than those of most privately owned fleets—all at a definite monthly rate that usually makes it more economical to lease than to buy.

NATURAL GASOLINE ASSOCIATION CONVENTION SYMPOSIUM

concrete basin below ground and is supported above the concrete floor by piers about its periphery. This concrete auxiliary tank is called the lower basin. The upper basin is contained within a circular fire wall placed some distance from the container. When the container is not used for gasoline storage a water level is carried slightly above the roof line. As gasoline is pumped into the container a hydrostatic balance is maintained on both sides of the roof by pumping water into the container above the roof. The pressure on the gasoline is equivalent to the hydrostatic head of gasoline in the stand pipe. The pressures are balanced either automatically or normally. One of the obvious advantages of this container is that the gasoline is entirely surrounded with water and evaporation losses should be very small. There is no vapor space on the gasoline surface excepting in the stand pipe.

In certain situations refrigeration may be resorted to in using light weight steel storage for holding natural gasoline. If spare compression capacity is available, the use of propane as a refrigerant in a compression expansion cycle is possible in holding down the temperature of the contents of the tank to the point where the vapor pressure is low enough to prevent serious evaporation.

Recent Fires and Explosions in the Natural Gasoline Industry

By EMBY KAYE
Skelly Oil Company

THE natural gasoline industry has made progress during the last decade. It has increased the efficiency of its extraction processes, improved the quality of its products and has reduced its manufacturing costs to an extent that has enabled it to exist in the face of radical changes in the price structure of light petroleum products. Not a little of this progress and reduction in costs is due to the relatively low fire and explosion experience in an industry loaded with extraordinary hazards. The plant designer recognizes the imminency of fires and explosions, and, as a result, not only surrounds his equipment with safeguards against these dangers, but as well chooses and locates the equipment with a view to reducing to a minimum such risks as must necessarily remain by the very nature of the business.

In spite of improvement in plant design, looking to the removal of some of the inherent risks in our industry, we have, nevertheless, a record of fires and explosions that have taken some lives and a considerable toll of property. While, no doubt, from all of them some of us have taken a lesson, your program committee considered that it would be for the good of the industry if some of these cases were discussed here in an open meeting. Dissemination of this information, throwing light upon the causes of these accidents, will accomplish a worthwhile object if we will each look into our plants, there to eradicate such conditions as obtained in the situations hereafter discussed, both in this paper and in the discussion to follow—conditions which led to disastrous results recited.

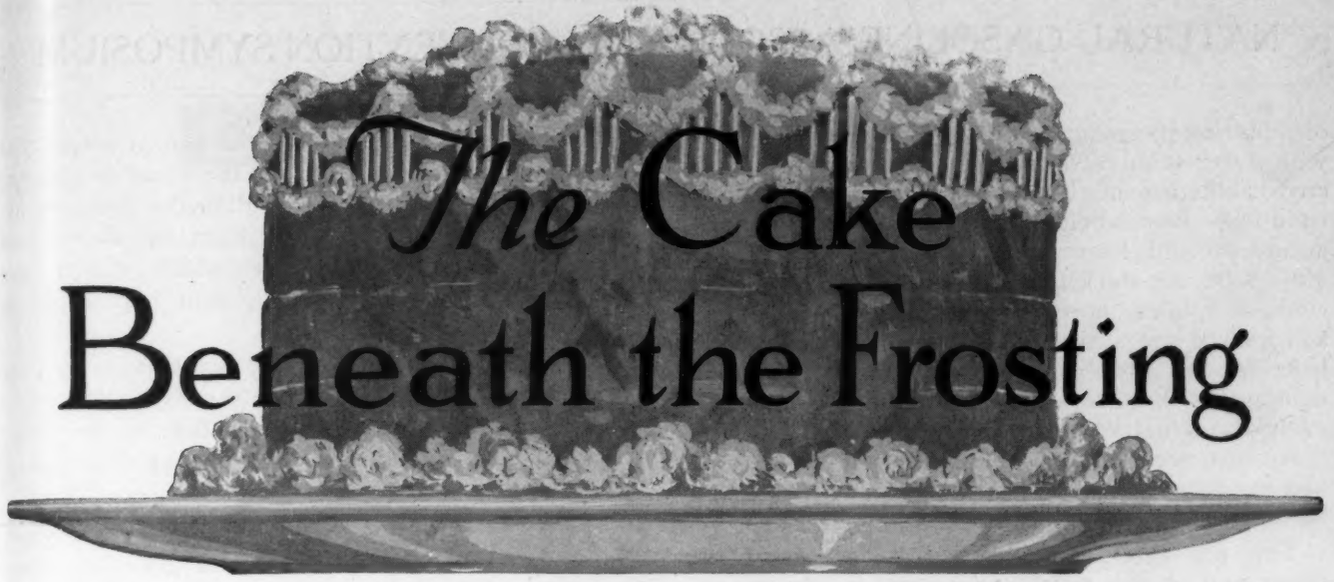
TONKAWA EXPLOSION

Let us revert, first, to the case of an explosion several years ago at a gasoline plant in Tonkawa field. This was an oil absorption plant powered with a ten-engined compressor unit. One unit was employed as a recompressor and was equipped with high and low stage cylinders for recycling make-tank and storage vapors. There were two headers in front of the battery of stock tanks which were manifolded with each tank and controlled by three valves cutting out each header separately, and also the stock tanks. Ordinary Crane valves of 125 pounds pressure and with the wheel handle were being used.

An operator at this plant began transferring gasoline from the make-tanks to a storage tank at 7:00 A. M. A half hour later he began transferring gasoline from another storage tank to the loading rack line. Through error, the operator left a valve open from the loading line to the stock tank into which he was transferring from the make-tanks. This caused the gasoline in the stock tank to overflow through the 2″ vent into a 4″ header, thereby filling the vapor scrubber tank, whence it entered the low pressure accumulator, from which it was carried over into the high side of the recompressor. In this cylinder the valve area is small and the piston travel about 400 feet per minute with about 1/32″ clearance. Liquids are not compressible and when the liquid reached here and did not compress, something had to give. The discharge valve gave way, ruptured the wall, and took part of the cylinder casting with it. The liquid then sprayed into the engine room and filled it with gas, which exploded about thirty seconds after the rupture occurred. The result was the loss of three lives and the severe burning of four others, also the complete destruction of the main engine room.

PRECAUTIONS

The company reporting this explosion advised that its precautions against a recurrence consisted, first,



The Cake Beneath the Frosting

ANY OLD CAKE can be camouflaged by a tempting icing—but it's not the looks that makes the cake, *it's what's beneath the frosting.*

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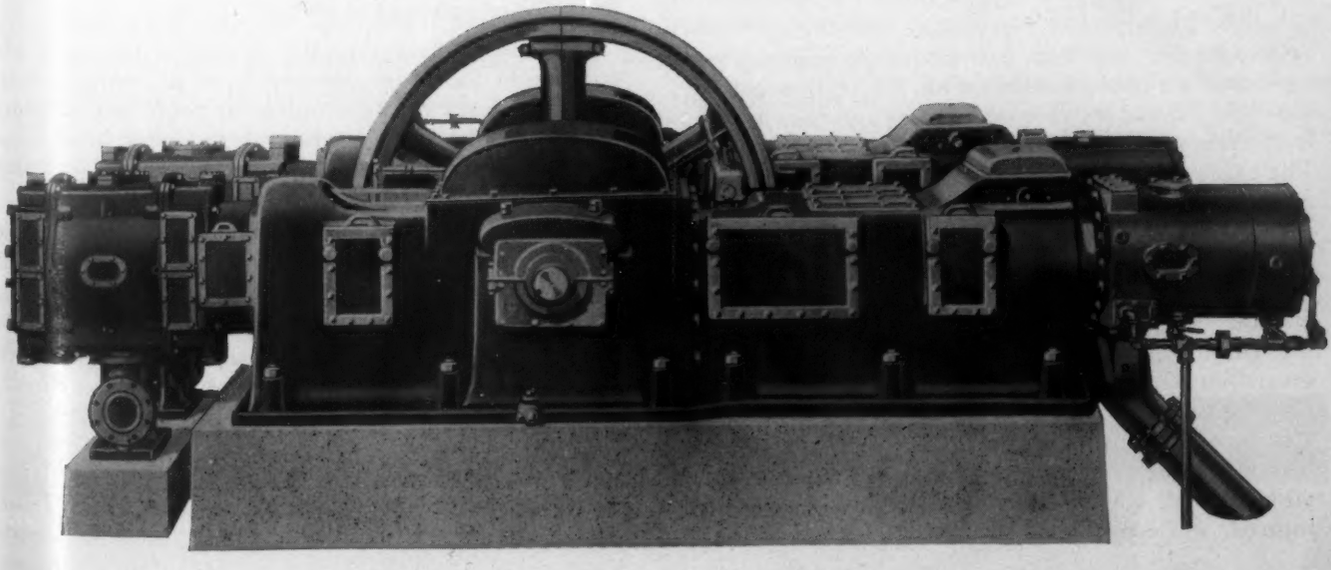

NATURAL GASOLINE ASSOCIATION CONVENTION SYMPOSIUM

of replacing the ordinary brass gates on the manifold with rising stem valves, which will show at a glance any valve that might be open, and, second, more rigid inspection when starting to transfer, since this accident could have been avoided had the gauge glasses on the stock tanks and the low pressure accumulator been more carefully watched. I should add a third precaution. It is always a good idea to have master scrubber tanks ahead of compressors, equipped with some sort of liquid level control, but even so, eternal viligance cannot be dispensed with.

An instance of an explosion resulting from an air and gas mixture in a plant using gas for lift or repressuring work, is the following:

This was a ten-unit plant using gas for lift purposes, and, on this occasion, one unit had been down for repair. At the time repair was started, the intake line was closed ahead of the scrubber tank and the discharge line closed near the discharge header, with a two-inch relief line left open. Through neglect on the part of someone, the two-inch blow off at the intake scrubber was left open (both the operator and mechanics deny opening this). When the equipment was again started, it was presumably operating on field gas and discharging through the relief lines until the equipment was purged of air. Then the relief line was closed and the machine was allowed to build up to the approximate header pressure. At this time it was turned into the discharge header and a violent explosion occurred, which ruptured the lines between the header and the high pressure cylinder of the machine, tore out the floor and part of the building, and injured one man seriously. Investigation disclosed that the machine had been building up pressure on air due to the two-inch blow off line being open in the bottom of the intake scrubber. There were several explosions of this same general character this year.

To prevent a recurrence of this kind, operators have been instructed to make sure all intake air connections are closed and the intake gas valve cracked, to allow the machines and lines to be purged with gas, throughout before starting to build up pressure.

On October 24, 1928, a company in Semonole experienced an explosion in an air-lift station employing eight 11x5x12-inch compressors and four 4-¾x11-inch compressors, driven by 125 H.P. gas engines. The explosion totally wrecked the discharge headers made of three-inch tubing of 2500 pounds test, together with all of the fittings connected on each end, but left the center intact. It also ruptured the discharge chambers on the high compression cylinders on nine of the 12 units and the discharge lines leading from the high cylinders to the headers. The seven lines leading from the discharge headers were also ruptured in two places, some 50 feet apart, and 100 yards distant from the plant. Much sheet iron was blown from the building and the windows were all shattered. One man was killed and one seriously injured, while five others required medical attention.

In spite of a thorough investigation, it seems that no satisfactory explanation for the cause of this explosion could be found, other than the probable accumulation of lubricating oil from the compressor cylinders in the discharge lines which ignited from the high temperatures resulting from high compression of air.

To remedy this situation, the plant has since been using soap solution to lubricate the high compression cylinders, after it was determined that, by the reduction of this soap solution with intense heat, no explosive gases were produced.

On the morning of November 23, 1928, one company suffered an explosion in a booster station located in Seminole field, caused by an excess of gas leaking into the compressor building, which, at that time was poorly ventilated because the windows and doors were closed. Presumably, the gas leaks came from around stuffing boxes on piston rods and probably from gate valve stems. An investigator talked with some of the operators who were running tour on this plant and it was their view that the explosion was due to the ignition of the gas by static electricity. It is believed that previous to the explosion, the operator on tour had removed some of the valves in the compressor, and this condition was found after the explosion when the gas was still leaking through the compressor where the valves had been removed even though the incoming gas had been shut off.

SUBMERGED CONTACTS

This booster station was operated by electric motors and it was also noted that the compensators had badly burned contact points and they were *above* the oil level. It was understood by some of the operators that on starting these motors, the compensators had a habit of sparking and flashing considerably due to the starting load, and, in all probability, the contacts were not submerged in oil. It is more than probably that the so-called static electricity was really a spark from the unsubmerged contact points.

It would appear that the design of the plant and equipment took into consideration the danger of ignition of gases in the compressor room and provided safety switches with contacts submerged in oil. This explosion might be an example of lack of watchfulness on the part of the operators.

On December 7, 1928, one company had an explosion in a Seminole field booster station, when high pressure on a third stage unit was by-passed into the intermediate stage (second stage unit) which bulged the accumulator tank bottom and caused all connections to be broken off, which in turn caused damage to the plant and surrounding buildings. The engineer became excited at the high pressure, by-passed same, and released about one mile of six-inch line with high pressure in it into the intermediate compressor, which equipment is constructed for 300 pounds work-

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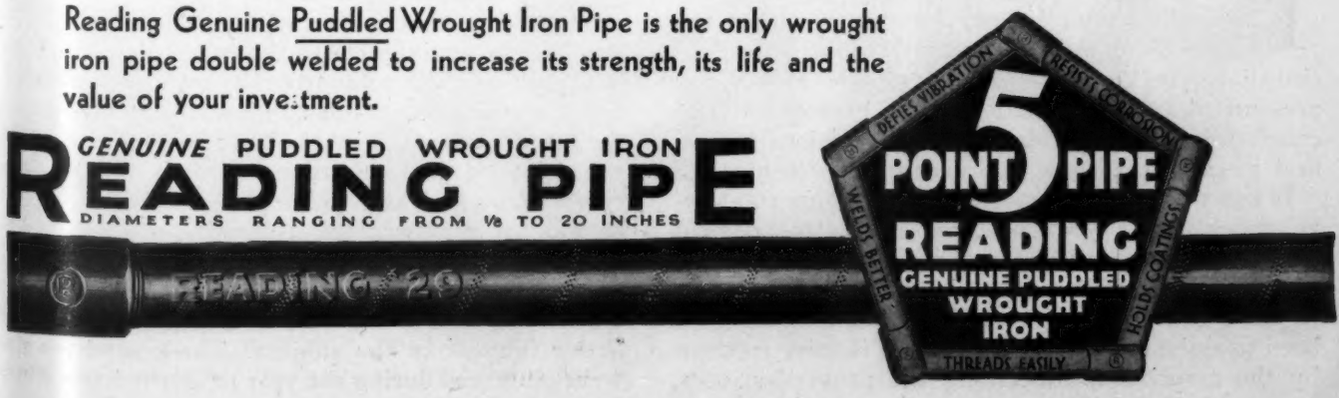

ing pressure. The relief valve did not have the capacity to take care of the volume in the six-inch line and something had to give.

Late in 1928, one company at Wewoka had a serious explosion in a gasoline plant-gas booster station, resulting in loss of life and property. The reporting company stated that it did not know definitely the cause of the accident, but it further remarked that it was possible that fittings installed for high pressure had among them some standard fittings which were difficult to distinguish from high pressure fittings. That company instituted an investigation in all its plants to check all high pressure cylinders, together with lines and connections on these units, to make certain that all these lines and by-passes to and through which high pressure could come into by error or through leakage, were properly equipped with relief valves or fittings of sufficient tested pressure to withstand the service.

CHECK VALVES

Our own investigation revealed that in any number of lift stations and plants, by-passes for emergency purposes were equipped with low pressure fittings because it was intended to flow gas from the low to the high side, but apparently no thought was given to the possibility of opening valves by mistake or of leakage by the high pressure shut-off valve on the by-pass, back into the low side, backing up ultimately a high pressure that would cause the bursting of the low pressure fittings, an eventually fraught with many dangerous possibilities.

The absence or failure of check valves on air starting lines has resulted in a number of explosions. Gas has been found to leak by automatic air starters and sometimes the filling or failure of a drip behind the air compressor has permitted gas or oil vapors to be compressed and ignited by the heat of compression, or by the back-firing of an engine.

A number of fires are on record, caused by the ignition of tank and loading rack vapors. Nothing new can be added to the story of safe handling of natural gasoline in a yard or at a loading rack. To do so would be to expatiate upon the obvious. Suffice it to say, it should always be done "tight," under pressure, and such vapors as are not retained should be conducted to a safe place and burned.

In this same class of cases come those where gasoline or gasoline vapors gravitated to the boiler house or engine room where they were ignited. It is a first principle with most companies to locate storage tanks in low places so that tank ruptures and burning gasoline would not be apt to endanger the balance of the plant.

It is obvious that the complete record of recent fires and explosions in our industry would look too much like a fire insurance agent's diary, to be given completely or in detail. An attempt has been made to touch upon the more important cases, to illustrate a class of accidents, and to indicate the probable cause. It is for the discussion to follow to bring out other and possibly more accurate pictures of the explosions mentioned, and others not here listed.

Of one outstanding indication, I have become thoroughly impressed. No matter how well your plant has been designed, or no matter how full of hazard it may be, it is my conviction that the plant will not—indeed, cannot—be operated with any degree of safety unless the operators are not only trained, but continuously trained and instructed in the purpose and import of all of the equipment in the plant, and particularly the "why and wherefore" of every valve under their control. Intelligent operation to back up enlightened design in absolutely necessary if we are to continue or improve the favorable record our industry has made.

Progress Report of the Technical Committee

By G. G. OBERFELL
Phillips Petroleum Company

THREE major problems vitally affecting the natural gasoline industry were referred to the technical committee during the past year. Specifications for motor natural gasoline and vapor pressure shipping regulations have been practically concluded. The third, dealing with revisions of natural gasoline grades, is approaching conclusion.

It was to call attention to these very important developments that your program committee desired this progress report to be included in the proceedings of the eighth annual convention.

Other activities of the technical committee have been to assist in answering letters of inquiry received by the association concerning the properties, uses, storage and handling of natural gasoline. It is interesting to note that several of these letters of inquiry are directly attributable to the research work of Dr. G. G. Brown. The committee has attempted to establish a more or less standard form of reply so that in the future such inquiries can be handled directly from the offices of the association, except in very unusual circumstances. The problem of establishing specifications for aviation natural gasoline was referred to the technical committee by the board of directors. Action on this problem was deferred because the United States Bureau of Standards has taken a very active interest in the subject. The committee also went on record during the year as approving a sched-

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It is used most extensively in the oil and natural gas fields for trapping out gasoline condensate from vacuum collecting lines and scrubber tanks. After the well or rock pressure has been exhausted from a producing area, vacuum is applied to the wells to increase the production of oil and gas. The collecting lines are also under a vacuum so that the gas is "drawn" to the compressor station or natural gasoline plant instead of being "pushed-in" by pressure. Before the collected gas can be successfully handled at the plant, all foreign liquids such as oil or gasoline condensate must be removed. Unless this is done, there is the grave danger of the liquids being carried into the plant where they may cause serious fires or explosions with resultant loss of life and property. In addition, the plant equipment is filled with foreign material and the quality of the product impaired by discoloration, odor, etc.

These liquids collect in low portions of the collecting lines where they are usually trapped into tanks or receivers and blown to the atmosphere at regular intervals by auxiliary pressure under manual control. At the plant, scrubber tanks, separators, or receivers are used to separate the liquids from the gas. Here also the liquids are blown from the tanks by an operator who manipulates a system of valves. *The FISHER Vacuum Fluid Extractor Type No. 36 takes the place of this operator, and removes these liquids automatically without human attention.*

This device is also adapted for trapping out or removing gasoline, various oils, water, and certain chemical solutions from a vacuum condition. When handling any of these liquids, the float chamber is suitable for the entire vacuum range and in an emergency can be subjected to a maximum pressure of 125 lbs. The actuating medium for forcing the liquid from trap can be air, gas, or steam under any pressure between 5 lbs. and 50 lbs. It is not possible to build this Extractor with one type of construction suitable for this entire range of pressure. For this reason, we ask that in requesting information you give the actuating pressure, so that the proper recommendation as to construction and range of adjustment can be given. The maximum recommended temperature for either the liquid or actuating medium, on non-corrosive service, is 400° F. With sufficient actuating pressure available, the Extractor can be used for trapping liquids either under vacuum or low pressure and discharging these liquids into a higher pressure region or into an elevated tank—the action is similar to the operation of a return trap.

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Fisher "Type 36" extracting gasoline from a vacuum line.

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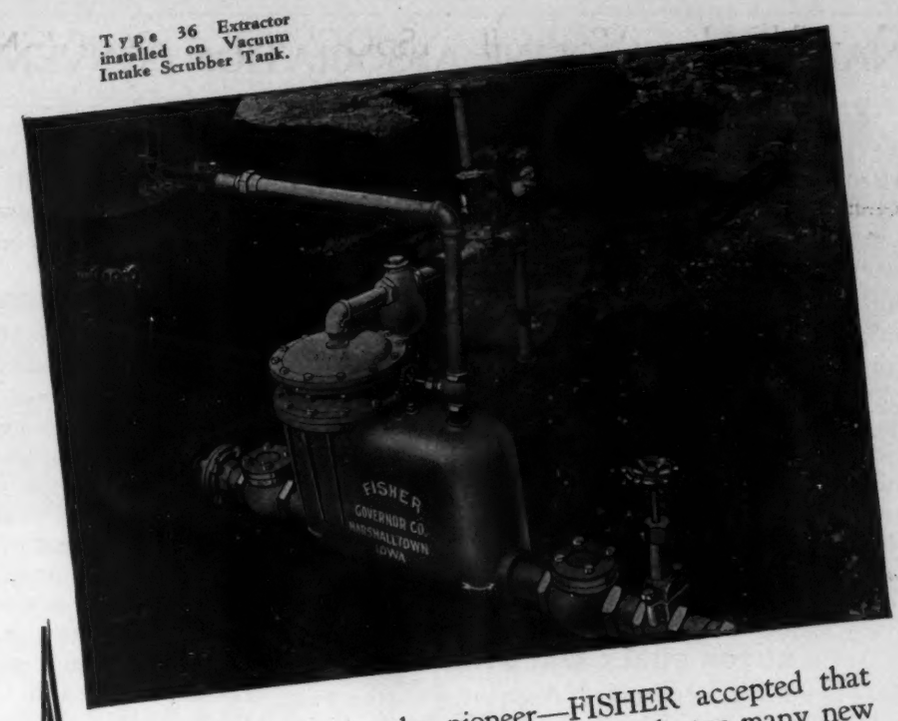

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NATURAL GASOLINE ASSOCIATION CONVENTION SYMPOSIUM

ule of loading densities applying to shipments of liquefied petroleum gas as proposed by the Bureau of Explosives. Prior regulations had been entirely inadequate for the products of the natural gasoline industry.

The first problem of major importance to receive attention of the technical committee was to establish specifications for motor natural gasoline. As compared with the earlier specifications for blended motor fuels, the purposes of the current work was to provide maximum volatility specifications so as to permit the satisfactory use of larger quantities of natural gasoline than are customarily incorporated in finished motor fuel. Needless to say, the association's research program formed the basis for the specifications established.

MOTOR FUELS SPECIFIED

Three grades were specified, designated by the average maximum atmospheric temperature for which their use is considered satisfactory. Thus Grade 90 is designed for use during summer months, where the average maximum atmospheric temperature approximate 90°F.; Grade 50 is intended for use in fall and spring generally and for southern winters; and Grade 10 is intended for the very cold winter months of the extreme north.

Specifications for the three grades of motor natural gasoline were as follows:

Tentative Specifications for Blended Natural Gasoline Motor Fuels, Adopted by the Natural Gasoline Association of America, effective October 1, 1928:

	Grade 90	Grade 50	Grade 10
Vapor Pressure at 90° F. not to exceed ..... (lbs. per sq. in. absolute)	6.5	9.0	11.5
Initial boiling point not less than (°F)	95	90	82
Temperature at 5% point (°F); not over	120	120	120
Temperature at 50% point (°F) not over 200-220	180-200	160-180	
Temperature at 90% point (°F) 380-410	360-410	340-410	
End point (°F) 425-450	425-450	425-450	

Note: Vapor pressure by Reid method adopted by N.G.A.A. effective Sept. 1, 1928. Distillation test by A.S. T. M. method D-86-27 with following additinoal provisions: Test to be made at a room temperature of not below 70 degrees F. Losses on distillation to be added to the percentage recovery in determining intermediate boiling points. Distillation test results based on a barometric pressure of 14.4 pounds per sq. in. obsolute.

It is to be noted, no specification for anti-knock value is included above. The anti-knock value of motor natural gasoline depends largely on the anti-knock value of the refinery stock used. It should be emphasized that considerable care should be exercised in selecting a refinery stock which will yield a resultant blend of satisfactory anti-knock properties.

Progress has been so rapid in regard to motor fuel specifications that in the brief interval since the announcement of three tentative specifications it has become necessary to revise them. It is highly probable that specifications covering the ten per cent, 50 per cent and 90 per cent points of the standard Engler distillation test will satisfactorily define motor natural gasoline. These revisions are now being considered by the technical committee.

DEFINITE OUTLET ASSURED

The establishment of specifications for motor natural gasoline will appear to many people an idle gesture inasmuch as present economic conditions are adverse to any considerable marketing of such products. The association however, feels that in establishing these specifications, it is assuring the industry a definite outlet for its production in the event of the curtailment of the refinery demand for natural gasoline. The committee also wishes to point out that the marketing of motor natural gasoline in relatively small quantities greatly improves the refinery markets for natural gasoline inasmuch as it creates a consumer demand for volatile motor fuels, reduces the available supply of natural gasoline and overcomes the ancient prejudice against "casinghead blends."

The second major problem to receive the technical committee's attention was that of transportation vapor pressure limits. Everyone present is no doubt familiar with many of the details of the prolonged efforts of the Bureau of Explosives to obtain a more reliable method for the determination of the hazards involved in the shipment of natural gasoline. Only the very excellent transportation record of the industry has prevented a change in the regulations prior to the time when the industry was equipped with sufficient data to safeguard its rights.

During the past few years a great deal of work has been done in regard to vapor pressure methods. At the same time analytical methods had been improved so that the results of such investigations could be reduced to a fundamental basis. These developments greatly simplified the comparison of vapor pressure methods. As a result, the Bureau of Explosives took the initiative in insisting on changing the method of determining vapor pressures.

TRANSPORTATION RECOMMENDATIONS

A very thorough study of this problem was made by the vapor pressure committee of the American Petroleum Institute. California operators presented their information through the California Natural Gasoline Association; Mid-Continent operators through the technical committee of the Natural Gasoline Association of America; and Eastern operators through their representatives on the American Petroleum Institute committee.

Practically all parties involved in the discussions were in agreement as to the unreliability of the old Bureau of Explosives vapor tension test. It had long been recognized that this testing method yielded results of very little significance. There was some opposition to the change from the industry on the basis that commercial requirements for natural gaso-

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NATURAL GASOLINE ASSOCIATION CONVENTION SYMPOSIUM

line provided sufficient safeguards. The preponderance of opinion in the industry was in favor of the change on the basis that a reliable vapor pressure test provided the best single commercial specification for natural gasoline. As far as the industry was concerned the problem was reduced to two aspects, namely, the selection of the most practicable vapor pressure testing method and the determination of vapor pressure transportation limits which would not materially affect the movement of natural gasoline. The Bureau of Explosives was convinced that sufficient data were available to permit the establishment of a reasonable accurate vapor pressure testing method.

As a result of the co-operative studies, the Vapor Pressure Committee of the American Petroleum Institute transmitted the following recommendations to the Bureau of Explosives.

1. The vapor pressure limits for Class 3 cars in terms of the Reid method which will not seriously disturb shipping conditions are 25 and 33 pounds per square inch absolute at 100°F. for summer and winter shipments respectively.

2. The corresponding limits for Class 4 cars are 40 and 45 pounds per square inch absolute at 100°F. for summer and winter shipments.

At the same time a tentatively standardized method of conducting the Reid vapor pressure test was submitted to the Bureau of Explosives.

These recommendations were made at New York, February 5, 1929. It is understood these recommendations of the American Petroleum Institute have been accepted in toto by the Bureau of Explosives with the addition of a single provision requiring tank cars used for natural gasoline shipments after January 1, 1931, to be equipped with dome covers designed to make it practically impossible to remove the cover while the interior of the tank is subjected to pressure.

The third major problem presented to the technical committee was the revision of specifications for commercial grades of natural gasoline. A sub-committee has been working on this problem for three months. Although the work is not concluded it is believed some benefit may result from a report of progress to date.

USE PARAMOUNT

The problem of segregating natural gasoline into five or less grades, each grade distinct from the others is indeed a complicated one. The present grades are totally inadequate to define the true value of natural gasoline. Only three of the present grades, AA, BB, and C, are active and by far the greatest emphasis is placed on Grade AA. Natural gasolines marketed as Grade AA are quite diverse in properties, ranging from 80 gravity, 98% recovery to 88 gravity and 90% recovery. The same range in properties is encountered in the other grades. At the same time the existing upper gravity limits exclude from the standard grades many valuable gasolines. As a comparison, why should a 94 gravity, 90% recovery gasoline be an outlaw grade when a 92 gravity 78 recovery gasoline is a standard product of the industry?

The purpose of any specifications is to adequately define the utility of the commodity to the greatest number of users. Consequently specifications should be drawn with the idea of providing the refiner with the best information regarding the use of natural gasoline for blending purposes. Gravity and distillation loss are only indirect measures of the value of natural gasoline. The committee has, therefore, been seeking more direct means of defining the useful volatility of our products.

The sub-committee working on this problem has reached the following conclusions:

1. Vapor pressure is the most important single characteristic of natural gasoline and should be the dominant specification. Since the vapor pressures of motor fuels bear a close relation to their vapor-locking tendency it is essential for the refiner to know the vapor pressure of natural gasoline. Vapor pressure might be considered an intensity measure of volatility.

2. Since vapor pressure might be due to a relatively small amount of very volatile constituents, or to a relatively large amount of fairly stable constituents, it seems necessary to provide also a quantitative measure of volatility. The intermediate Engler boiling points, etc., of natural gasoline afford a quantitative measure of the volatility of the product. After a great deal of study the sub-committee has tentatively established the Engler percentage off at 100°F. (corrected for distillation loss) as the most satisfactory single intermediate boiling point for specification purposes. The functions of this specification are:

(a) To move the product into a higher vapor pressure range when the quantitative volatility becomes so high as to cause the product to have high residual vapor pressure after ordinary handling losses, either blended or unblended.

(b) To move the product into a lower vapor pressure range when the quantitative volatility becomes so low as to cause the product to have low residual vapor pressures after ordinary handling losses, either blended or unblended.

3. The present specifications, gravity and distillation loss, bear only the most general relationship to the fundamental specifications now under consideration. Distillation loss has very little significance, while gravity bears a rough relationship to quantitative volatility.

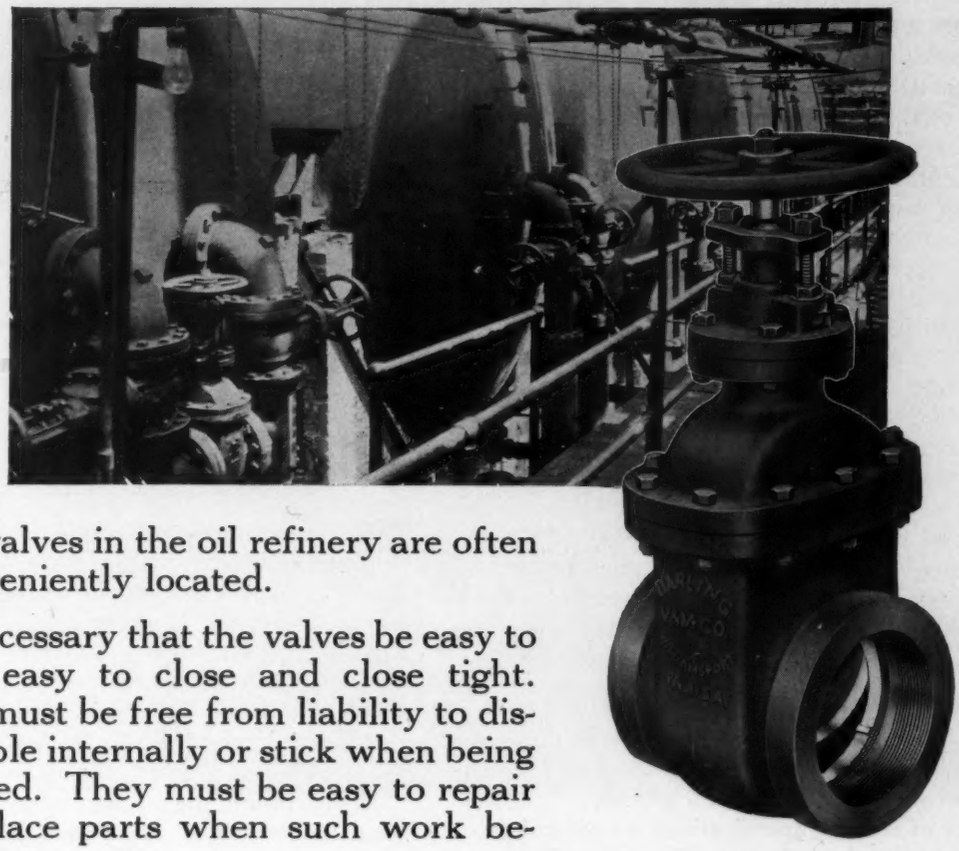
4. The specifications to be proposed by the sub-committee will probably assume the following form:

Grade three Reid Vapor pressure at 100°F. in pounds per square inch absolute 22-26.

Engler per cent. off at 100°F. corrected for distillation loss, 30-60.

If natural gasolines in this vapor pressure range have less than 30 per cent. or more than 60 per cent. off at

Darling—The Gate Valve For Refinery Service



Gate valves in the oil refinery are often inconveniently located.

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100°F. they shall be placed in Grade 2 and 4 respectively.

5. Although it will be impossible to establish grades on the basis of the proposed fundamental specifications which will exactly coincide with existing grades, the sub-committee believes it will be possible to state which of the new grades most nearly corresponds with each of the old grades.

6. Much thought has been given to the number of grades to be established. The sub-committee feels that five grades are necessary. During periods of overproduction of natural gasoline the less volatile grades will receive market emphasis, while in periods of underproduction the more volatile grades wlll be emphasized.

7. General application of sound engineering principles in the natural gasoline industry has resulted in two factors which have contributed chiefly to the obsolescence of the present grades. These factors are:

(a) Improved extraction efficiency and the widespread adoption of the oil absorption process. These tendencies have increased the pentane content of the butane free base and at the same time have increased th quantities of butane available for inclusion in the finished natural gasoline.

(b) Improved fractionation of the raw condensate. This tendency has made it possible to exclude dissolved gases from the finished products. This has meant further additions to the butane content of natural gasoline.

SHOULD EXTEND MARKETS

The possibilities for further development of these two factors are by no means exhausted and this will be considered in the establishment of new grades.

This matter of revising specifications for natural gasoline is most vital to the industry. The economic phases are quite important. The present specifications place a barrier against unusually high volatility by means of the upper gravity limits. This upper gravity limit acts as a check on production, although high gravity products are successful in finding markets. No revision of the present grades on the basis of fundamental specifications will be possible without a complete understanding of what natural gasoline is. It is the thought of your technical committee that if natural gasoline is graded according to specifications which directly denote its value to the refiner and which more or less reflect the cost of manufacture, a desirable end will have been gained. Both the buyer and seller will know what the product is worth. Furthermore, by knowing the fundamental physical characteristics of natural gasoline, the user will be able to more intelligently purchase the commodity. Thus, it is to be expected that markets for natural gasoline will be extended by rational specifications.

No progress report of the technical committee for the year 1928-1929 would be complete without praising the diligence and faithfulness with which the members of the committee have attacked the problems assigned it. It has been a pleasure to be associated with the gentlemen of the technical committee. Without their zealous cooperation very little would have been accomplished. The executive organization of the association is also to be commended for its cooperation. Had it not been for its prompt response, during the vapor pressure controversy, the Mid-Continent industry would have had very little voice in the deliberations which led to the decisions made in this matter. Credit is also due in no small part to the California Natural Gasoline Association for its splendid cooperation whenever they were asked to help.

In conclusion, the advance of technology in the petroleum industry is so rapid that the technical committee promises to be one of the most important and active of the association's committees. The best technical talent available should be selected for the work and every opportunity given the committee to function efficiently.

Repressuring and Its Effect on the Natural Gasoline Industry

By E. O. BENNETT
Chief Engineer, Marland Companies

OIL is caused to move to wells drilled into a producing formation only by the utilization of the energy available in the formation. In the producing formations encountered the energy may be present in three forms.

(1) Potential energy due to the force of gravity.

(2) Energy due to hydrostatic pressure from a water source.

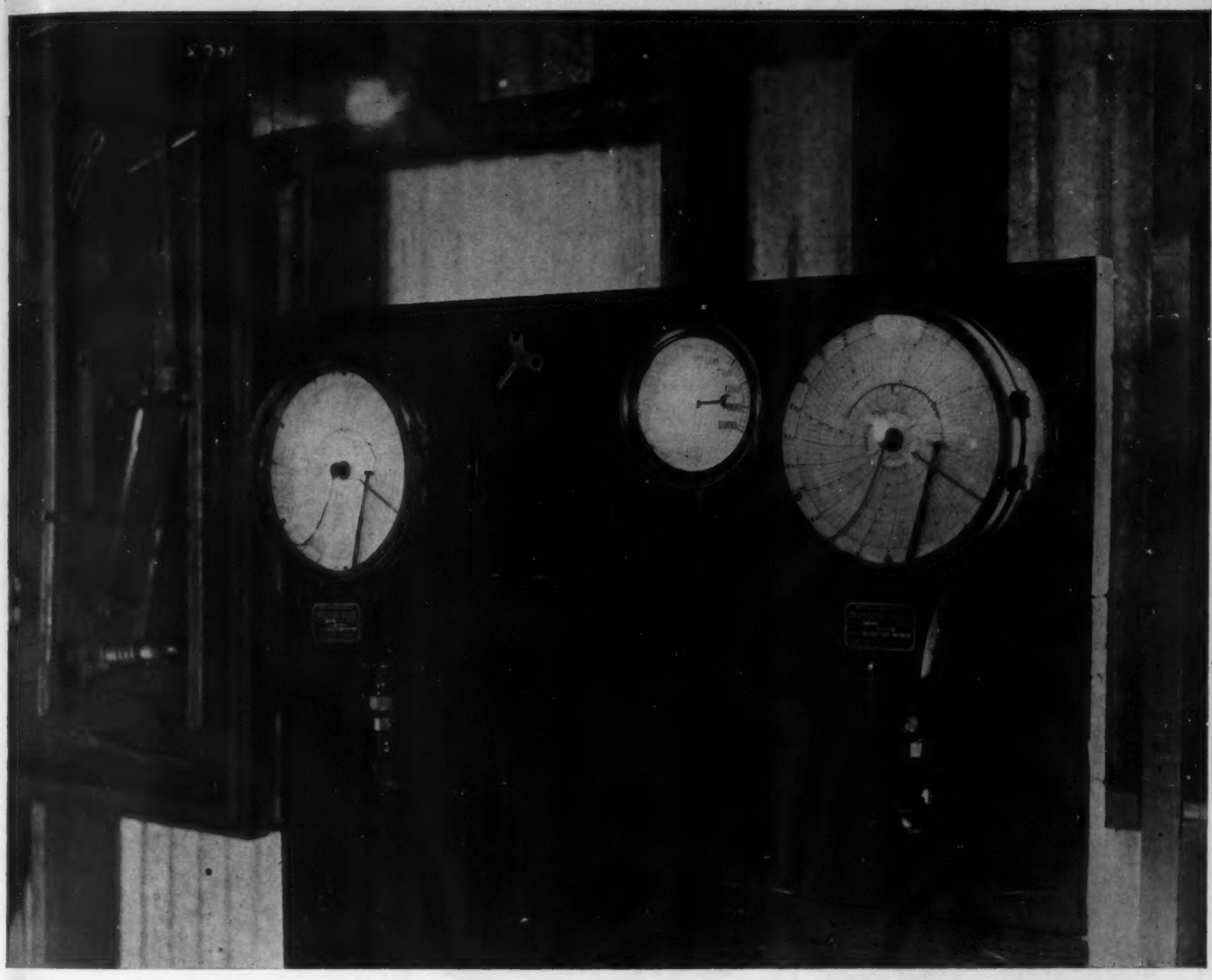
(3) Potential energy due to gas under pressure in solution and in contact with the oil.

The first source of energy is present in certain types of structures and assists in drainage where the second and third forms are not present. While gravitation drainage will help to recover some oil, it is of but little importance and can be practically neglected owing to the fact that the resistance to flow is high, on account of porosity and permeability. Where production is acquired by gravity drainage alone, it is generally small and beyond economic limits.

Production obtained by the action of hydrostatic pressure is of major importance and exists in a large percentage of the producting areas in the United States. So far but little work has been done in repressuring where water furnishes the principal motive power for the moving of oil.

Practically all subsurface accumulations of oil exist under pressure conditions of considerable magnitude. Generally the greater the depth, the greater the pressure existing, averaging about 33.8 pounds per 100 feet.

Petroleum is a complex substance composed of hydrocarbon molecules in various forms according to the temperatures and pressures under which it was



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formed and exists. Gas accompanies all oil deposits which exist under pressure. Some of the gas may be in solution and come in contact with the oil in the producing formations.

The amount in various forms depends upon the nature of the oil and the physical conditions under which it exists in structures.

Flush Fields Next

The natural gas gasoline industry is primarily concerned with those structures that produce oil primarily motivated by energy contained in gas under pressure. Up to a few very recent projects the majority of all repressuring operations were conducted upon old and practically depleted properties where gasoline producers were but little concerned. Work done in repressuring depleted fields showed very clearly that where energy from external sources could be injected into structures, that useful results would be accomplished. The useful results being in the form of increased oil recovered. Results thus obtained caused the petroleum engineer to go a step further in working out ways and means of conserving available energy on flush fields, so that today the practice is coming into general use.

On the basis that gas energy is all important in the recovery of oil, engineers and operators are now trying to determine the best way to utilize the energy in producing formations.

Two main points which will effect oil and gasoline recovery in this regard are:

(1) Production should be handled in such a manner that the least possible amount of gas energy per barrel delivered is used.

(2) All available gas produced with the oil should be returned to the formation producing it as soon as possible after it is produced and should not be sold for fuel if it can be returned for oil recovery purposes.

The principal manner of producing oil with a minimum amount of gas energy per barrel is by determining the proper production rate for each well by experimentation and observation. Gas production along with oil is chiefly governed by pressure differential between the well bore and the producing formation. This is commonly called back pressure. Where the differential pressure is kept to a minimum, the maximum amount of gas will be retained in the oil and formation, and many beneficial results will be obtained.

Keeping gas in solution by maintaining high pressures, maintains the viscosity and surface tension of the oil at a minimum and as near its original state as possible. Viscosity is the principal factor offering resistance to the flow of oil through porous formations. Where the viscosity is kept to a minimum value less energy will be required to produce a barrel of oil than will be necessary where gas is allowed to escape without doing work. Beacher and Parkhurst say "Viscosity is the most important physical characteristic of crude which affects the rate of flow through small irregular openings of a sand. The quantity of oil that will flow through openings is inversely proportional to the viscosity, other conditions remaining constant, while the pressure required to produce a given flow varies directly as the viscosity. For example, if the viscosity of the oil should be reduced 50 per cent. twice as much would flow through the sands if other conditions remain constant, or one-half of the pressure would be required to force an equal amount through the sand."

Repressuring old and depleted fields has returned big profits on money invested for this purpose. Recent pressure maintenance operations on flush and semi-flush production have proven equally profitable and have substantiated the value of immediate work on returning gas to a producing formation. Ultimate yields of from 50 to 100

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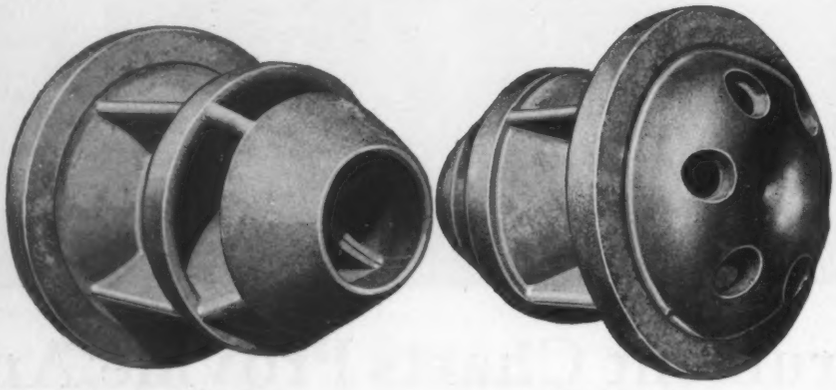

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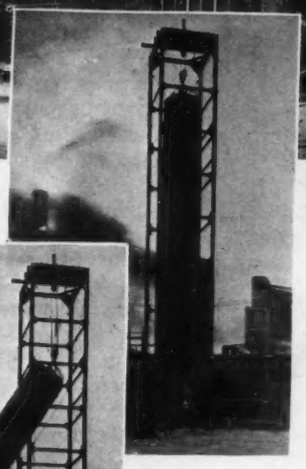

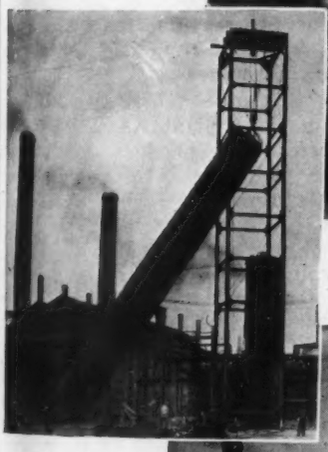

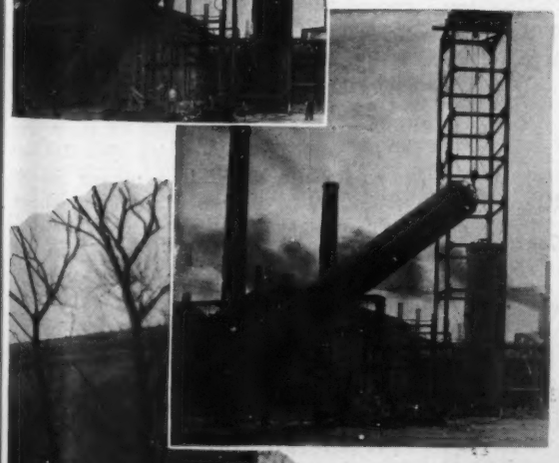

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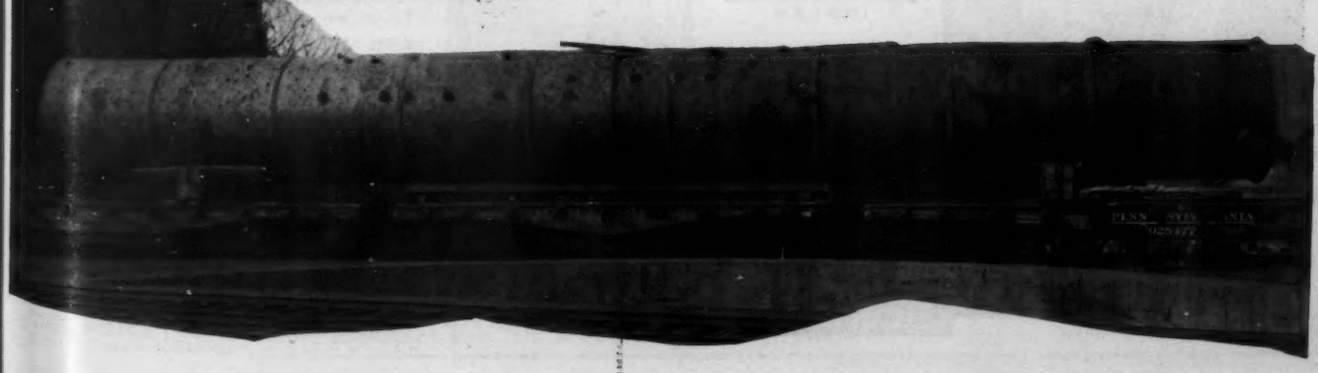

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per cent. more than those normally recovered, may be expected if proper applications are made.

Maximum Economic Recovery

The effect of repressuring and manitenance operations, on the natural gasoline business will be to stabilize the market and eliminate the large volumes of the product with flush production and a shortage with declining oil production.

The maximum ultimate economic recovery of petroleum products, including natural gasoline, will be covered when:

(1) As much gas as produced is returned to the formation without extracting the gasoline content it carries until production obtained under this program is carried to its economic limit.

(2) After production is no longer economical, gas can be circulated and the gasoline recovered until such time that no more can be economically taken from the formation.

(3) When dry gas injected returns to the surface dry, there are no more recoverable products except gas, unless mining is resorted to.

(4) Withdraw the gas and use it for fuel.

To do these things will mean that there will be no gasoline plants built and operated in flush fields. Compression plants taking gas from high pressure traps will be used for returning wet gas to the formation. Drip gasoline recovered in this process should be injected into key or input wells to assist in washing crude oil from the gains of the structure. Pressures as high as 1500 to 2000 pounds per square inch may be required but there are no mechanical difficulties involved in high pressure work. Installations in California have already shown the advisability of using pressures up to 1800 pounds per square inch.

After the injection period at high pressure has passed, the compressors can be fitted for circulating gas in the oil bearing formation for the recovery of gasoline vapors. During this stage of operations, dry gas is necessary and absorbers should be used in conjunction with the compressors.

When this type of program is followed, gasoline plant operations will not interfere with production methods and vice versa, as is often the case where best results to each are required without regard to the total ultimate recovery.

Returning gas to the structure in the time of flush production will not overcrowd the gasoline market and residue gas market as has been the case in many instances. A conservative use of gas would prevent great quantities from being wastefully consumed in the manufacture of carbon black, as now practiced and would require the development of more efficient means for the manufacture of this commodity. The return of gas to the formation would make enormous quantities of gas now wasted, available for efficient use in ultimate recovery. It would spread the period of gasoline recovery over a wider range and call for less investment in gasoline equipment and less idle gasoline plant equipment as always appears after the flush is off a field.

It is realized that there will probably be more gas available in flush production than can always be returned. Where this condition exists the use of gasoline plants for stripping the gas before selling as residue, is a conservative operation. For greatest ultimate economy, however, this method will not be used as much as it has in the past.

One of the main reasons why repressuring flush fields has not come into general use, is on account of the natural gasoline situation as it exists to-

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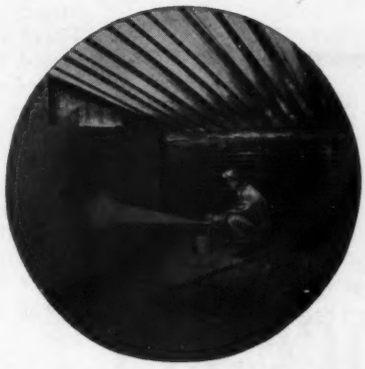

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day, it being customary to use all available gas for gasoline extraction.

More Oil—More Gasoline

When gas is consumed for gasoline recovery and then burned to carbon black or sold as residue, there soon becomes a shortage and both the oil producer and the gasoline producer are forced to quit operations prematurely and uneconomically leaving unrecoverable many thousands of dollars worth of oil and gasoline that could otherwise be recovered.

The value of maintaining pressure on flush operations is shown by a few installations where all available gas is returned to the sand wet. In some instances consideration is being given to the advisability of burning crude for fuel to have more gas for returning to the formation. The use of wet gas has a decided value over dry residue in its scrubbing action on releasing oil from sand grains. One can readily see the advantage of using wet gas when it is shown that the oil in the surface of the sand is much greater than that in the pore space.

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Where gasoline plants are in operation and the residue returned to the formation, longer life to both production operations and gasoline plant operation is assured and a much greater return to both will be obtained than where residue is blown to waste, sold as fuel or burned to carbon black.

There are a great many producing operations today where gasoline plants are operating in conjunction that would be greatly benefited if the gasoline plant were operated as a link in the repressuring or pressure maintenance cycle. There are too many gasoline plants operated for gasoline alone, without any regard whatsoever for the ultimate production of oil from the wells to which they are connected. Any system of operation which will increase the ultimate recovery of oil will also increase the ultimate recovery of gasoline and if generally practiced would produce gasoline with a stable market resulting in better values.

The total cost of pressure maintenance can be lowered when worked in conjunction with gasoline plants, as well as lower the cost of gasoline production.

Where gasoline is being extracted in the pressure maintenance or repressuring cycle, the lighter fractions of the gasoline, ordinarily weathered can be returned and are very beneficial for washing oil from the sand when injected into pressure wells.

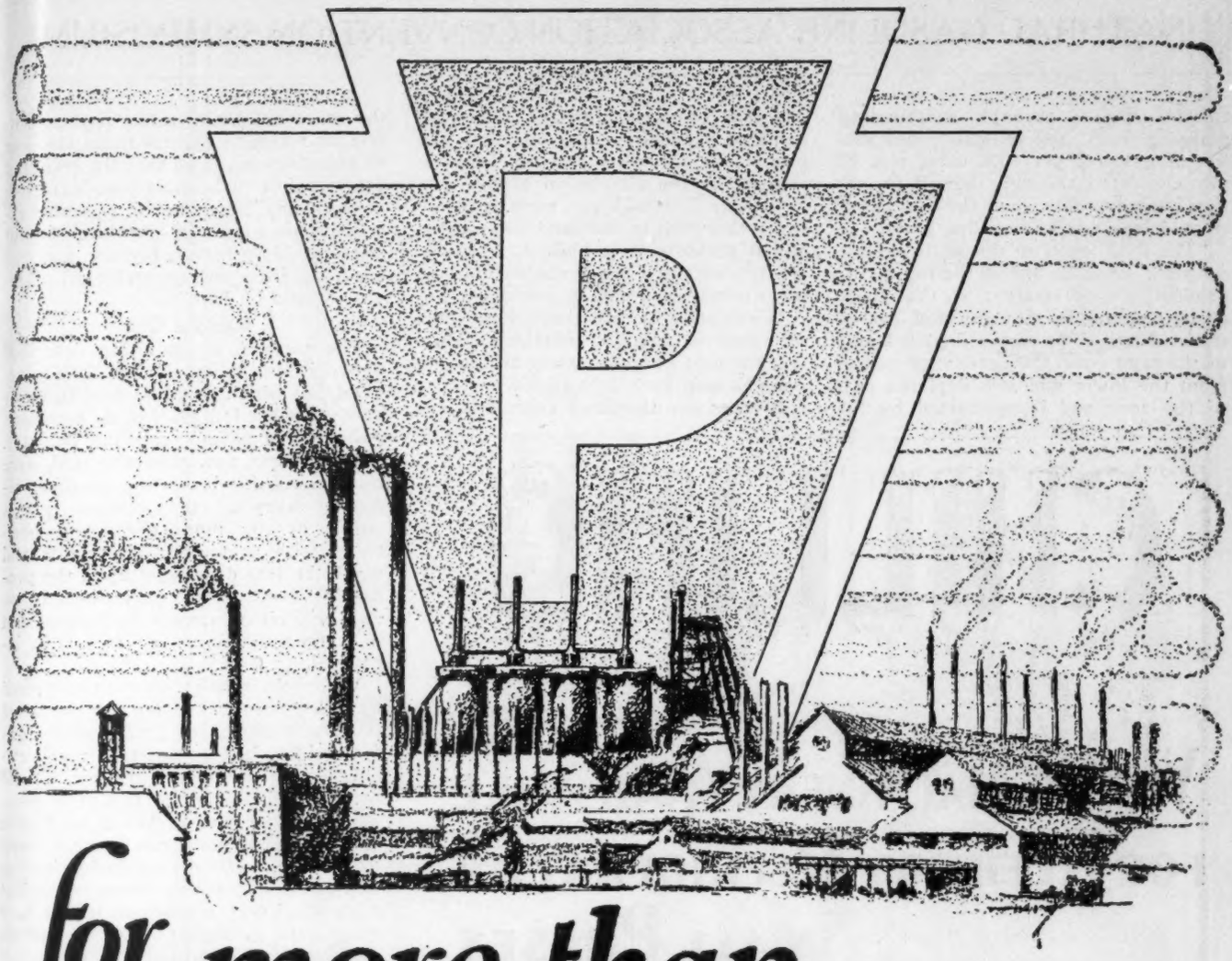
Operating gasoline plants in connection with repressuring operations is beneficial in that it is not necessary to pull vacuum on wells to recover the gas. Vacuum sufficiently applied is detrimental to wells and machinery for maintaining vacuum is more expensive than that for maintaining pressure for a given volume. Generally enough pressure will be maintained to force the gas to the plant without injury to the repressuring operation.

The gravity of oil produced under a pressure maintenance without the extraction of gasoline is generally increased from one to three degrees, thereby giving an added value to the oil. The return of the gas in some cases is actually worth more in increased gravity than if used for gasoline extraction.

[1]"Dry gas is injected into depleted oil sands in the Coalinga and Buena Vista Hills oil fields in California to recover gasoline from unrecoverable oil which adheres to the sand grains. As operations in both fields are prectically identical, only the Coalinga project will be described.

"At Coalinga, dry gas is injected into the oil sand on one property through a single well at an average pressure of 40 pounds per square inch, and returns

[1]Function of Natural Gas in the Production of Oil, U. S. B. M. and A. P. I., May, 1929.



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NATURAL GASOLINE ASSOCIATION CONVENTION SYMPOSIUM

to the surface through surrounding pumping wells. Approximately one gallon of gasoline per 1000 cubic feet of gas circulated through the oil formation is recoverable when the wet gas is treated in a nearby gasoline plant.

"The fluid levels in the wells on this property stand far below the top of the productive sand stratum, so that there is opportunity for the injected gas to travel through the upper depleted part of the sand zone. Oil production comes from the lower and less depleted part of the zone and is unaffected by the gas that by-passes through the more depleted sand above the oil level. Oil production, therefore, has not been increased by the circulation of dry gas. However, if enough gas were available to fill the voids in the sand completely, and if pressure were built up over the whole structure, it is probable that the oil production would be increased.

"Circulating dry gas through depleted oil sands is usually profitable. Seldom will the cost of compressing and injecting gas into such formations exceed a few cents per thousand cubic feet. On the other hand, the value of the gasoline recovered is several times the cost of manufactuing it, so that the resulting profit makes such operations lucrative; at the same time, the oil operator increases his supply of gasoline without affecting his reserves, because gasoline absorbed from unrecoverable oil otherwise would be lost."

Residue Gas

The method of operation described above is one which is but little practiced, but which could be used in many partly depleted fields for an economic gain by the natural gasoline industry. If residue gas, now generally sold, were recirculated for increasing gasoline recovery many of the gasoline plants would occupy more permanent positions, with protected investments and would be less dependent upon the production status of oil operations. In no case will oil operations be injured and in many the ultimate yields will be increased.

Where the gasoline content recovered by a thousand feet of dry gas circulated is equal to the market value of the gas for residue, it does not take much calculation to see where the gas should be used. Once sold for fuel, it is gone, never to be replaced. When used on a recycling program it can be used many times over, each time producing it original value in gasoline recovered and at the end of such a program it will have its original or higher value for fuel on account of a stabilized gas market, if such practices were generally resorted to.

The conservation of natural gas in the production of oil is of paramount importance. It is conservatively estimated that in a single year gas conservation would result in the production of many millions of barrels of oil, in addition to that nominally recovered. If the gas ordinarily produced and consumed or wasted was used for pressure control, pressure maintenance and repressuring many millions of dollars of oil would have been realized that now remain unproduced and largely irrecoverable because of uncontrolled porduction methods. In addition a great many of the wells would have flowed naturally for a longer period under pressure control and increased production with lowered lifting cost, would result leaving a greater profit per barrel produced, although the gas produced with the oil in excess of the estimated amount required to produce oil, efficiently has a value of several million dollars at the casing head it would have had a far greater value if used for expulsive energy in moving oil through the sand to the wells.

Summarizing

1. The natural gasoline industry will be greatly benefited by repressuring and pressure maintenance.
2. Gasoline plant operations fit in

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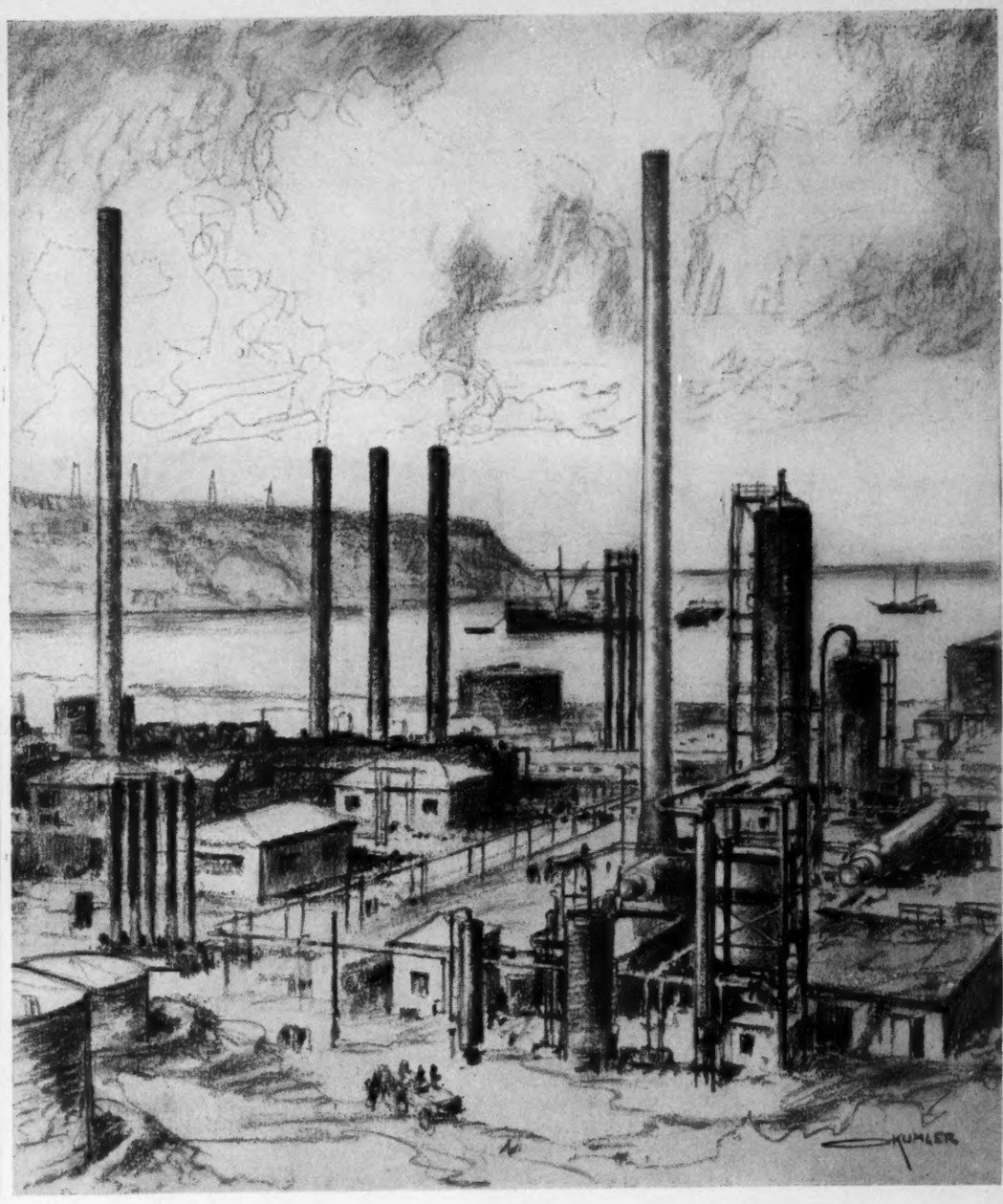

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NATURAL GASOLINE ASSOCIATION CONVENTION SYMPOSIUM

with repressuring operations and can help the ultimate recovery of each.

3. Gasoline plant operations maintained without regard to oil production, may be detrimental to both the gasoline plant and oil production.

4. Cooperative operation of gasoline plants and repressuring programs has worked successfully and greatly subsidized operations.

5. Repressuring in connection with gasoline production will tend to stabilize the gasoline market.

6. Repressuring in connection with gasoline production will minimize initial equipment cost in gasoline plants and keep operating charges low.

7. Unified operation over large areas is conducive to best results but good results can be obtained on a smaller scale.

8. Repressuring and pressure maintenance is a move towards conservation in the production of oil and anything which assists in helping in oil production is a corresponding help in gasoline operations.

9. Close cooperation between gasoline plant operation and production operations will be highly beneficial to each and pay good returns.

10. After both gasoline and production practices have been carried to economic depletion, the natural gas industry will derive full benefit from residue gas left and their investments in transmission lines will be protected.

"Light Ends"

By GEORGE REID

The eighth annual convention of the Natural Gasoline Association of America was opened by an address of welcome by Frank L. Chase, as usual. Chase, Lone Star Gas Company, Dallas, is the "champion convention opener" of the natural gasoline industry. Of the association's eight convenings, Chase has welcomed all but one. He has a standing invitation to open as many more gasoline manufacturers' conventions as he cares to. His message this year as he himself "boiled it down" was to the effect that you must give as well as receive and that you get out of a convention exactly what you put into it.

Dr. S. F. Birck, of the research staff, Anglo-Persian Oil Company, London, England, was present. Birch is well known to the manufacturing branch of the petroleum industry through his work with A. E. Dunstan, D. Sc., and F. B. Thole, D. Sc., of the same company, in the development of the hypochlorite process of chemical treatment of petroleum distillates. He also took the honors as having traveled the greatest district to attend the convention.

Every year General Supt. W. E. Rearden, Columbian Gasoline Corporation and Coltexo Corporation greets old friends at the convention. With him he brings as many of his gasoline plant superintendents as can be spared from their work. This year there were four. Columbian Gasoline Corporation operates five plants in the Monroe, Louisiana area, and one in the Texas Panhandle. Coltexo Corporation has one plant in the Monroe area and two at Lefors, Texas. Plant No. 1 at LeFors is being enlarged through the addition of eight compressors, bringing the total to 24, and additional distillation equipment is being added there also. Ten compressors are being installed at plant No. 2 at Lefors. Supervisors and foremen of plants of these two companies meet monthly at foremen's meeting to discuss papers written by the men regarding their problems. Several of the foremen's papers have appeared in these columns during the past two years.

L. G. Thompson, manager Big Lake Oil Company's absorption natural gasoline plant, Texon, Texas, claims to have a pull with Uncle Sam. His address is Post Office Box 1.

In conversation with J. A. Campbell of Long Beach and the writer, L. G. claimed to be operating a plant with the hardest water on earth. "When you throw this water down on a concrete sidewalk, it rattles," says Mr. Thompson. Incidentally, the Big Lake plant is operating on sour gas at present, average five gallons recovery per thousand cubic feet. The gas bears eight and 10 per cent. hydrogen sulphide and dispite this, the treating cost, using the hypochlorite process, is one mil per gallon. Big Lake Oil Company is drilling four wells to the 8200 foot oil producing level from which zone a sweet gas is produced—also a sweet 56 gravity A.P.I. lemon colored crude oil.

M. R. Church, Shell Petroleum Corporation, who has been in charge of operation of two natural gasoline plants in the Braman, Oklahoma district, spent much time at convention sessions, and like a great number of others, made many notations. Church is temporarily located in Tulsa doing appraisal work for the company. Through no fault of his, Church is a fraternity brother of the writer.

T. G. Laney, formerly with Fisher Governor Company, and Wm. D. Moore, formerly New York and Tulsa branch office manager for C. F. Braun and Company, were meeting friends at the convention. Laney and Moore have recently formed the Moorlane Company, Inc., with headquarters at 805 Tulsa Loan Building, and they are handling tube turns, forged steel flanges, and Audiffern refrigeration machines.

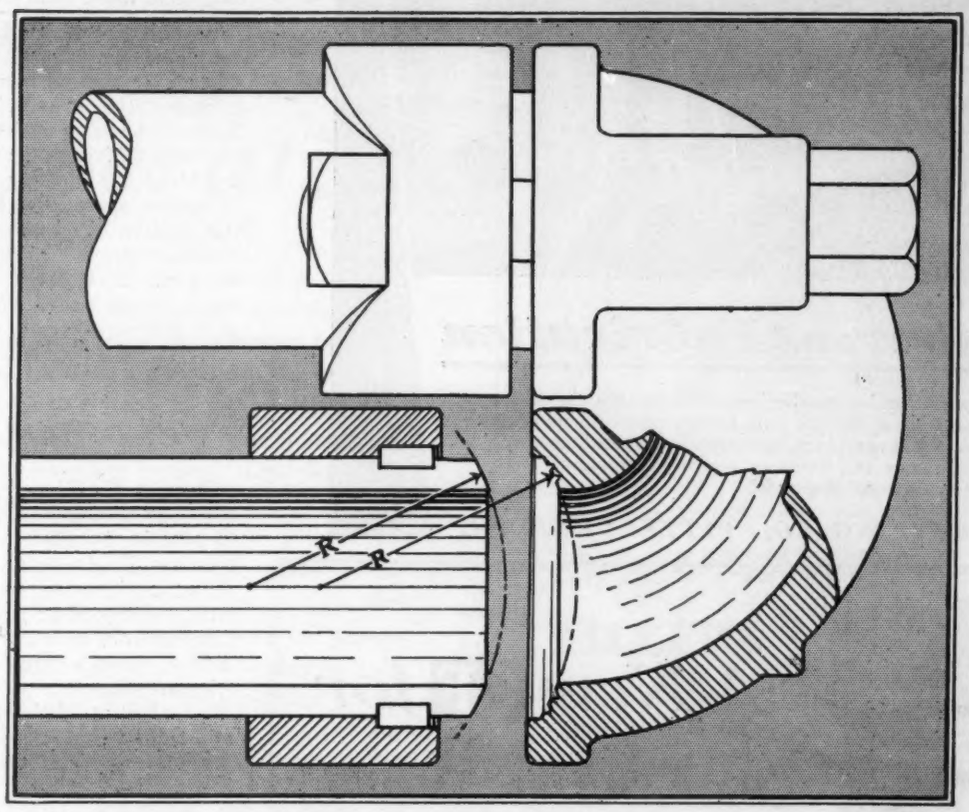
A. V. Bourque, past secretary of the Natural Gasoline Association of America and now with the Western Petroleum Refiner's Association, was seen milling around with his many friends at convention sessions. A. V.'s presence contributed much to giving the convention that "natural" appearance.

Dr. George Granger Brown's complete report will appear in book form some time later this year. Brown cited a series of tests made in Detroit having to do with dilution in the crank case. He stated that experiments proved that 15 per cent. dilution was nothing to worry about. Twenty per cent. dilution was actually desirable during cold months. Further, 50 per cent. dilution is not at all dangerous according to these tests and danger is not involved until 80 per cent. dilution is reached. Perhaps there is not so much to this dilution bug-a-boo after all. Some one offered the suggestion that cars ran beautifully before we knew there was such a thing as dilution of oil in the crank case. Further work along these lines will be watched with interest.

George L. Ratcliffe and ten Californians, in a special car from California, arrived early for the meeting. George L. Ratcliffe, General Petroleum Corporation; D. M. Wolfe, Standard Gasoline Company; W. W. Robinson, The Texas Company; Ben C. Dumm, Cooper-Bessemer Corporation; Louis V. Cassaday, Lomita Gasoline Company; J. W. Reed, Cooper-Bessemer Corporation; J. S. Watson, Shell Company of California; E. L. Tobias, Bankline Oil Company and The Norwalk Company; A. A. Thomas, Hope Engineering &

SECO RETURN BENDS

Only Two Joints in Each Fitting



The spherical tube end and seat in Seco Return Bends make a leakproof joint, even if the tubes are of uneven length or slightly misaligned

THERE are but two joints in a Seco Return Bend—between the ends of tubes and the seats in the fitting. Both these surfaces are machined on a radius so that they are spherical segments, and consequently make perfect contact even though the tubes are of uneven length or slightly misaligned.

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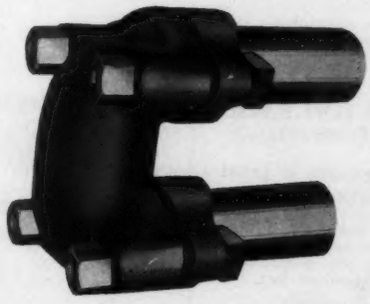

The design of Seco Return Bends incorporates five other money saving features that it will pay you to know about. Complete information will be sent you promptly without obligation. Address your request to the nearest office.

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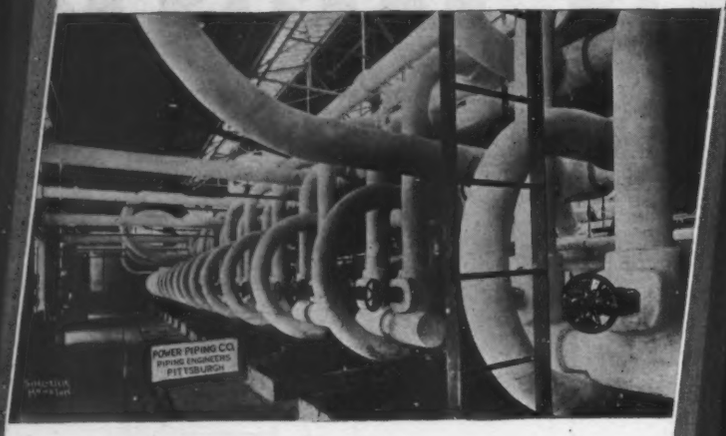

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Supply Company; J. A. Campbell, J. A. Campbell Company, and H. J. Snyder, C. F. Braun & Company, comprised the West Coast delegation.

W. W. Robinson brought with him and read the paper prepared by himself, P. S. Magruder of General Petroleum Corporation; J. C. Burks, O. C. Fields Gasoline Company, and E. R. Cox, The Texas Company, dealing with the application of fundamental analysis to absorption tower operation, which was one of the most interesting and valuable papers presented at the meetings. Discussion of this paper, led by R. O. Campbell, Skelly Oil Company, brought out some most interesting information.

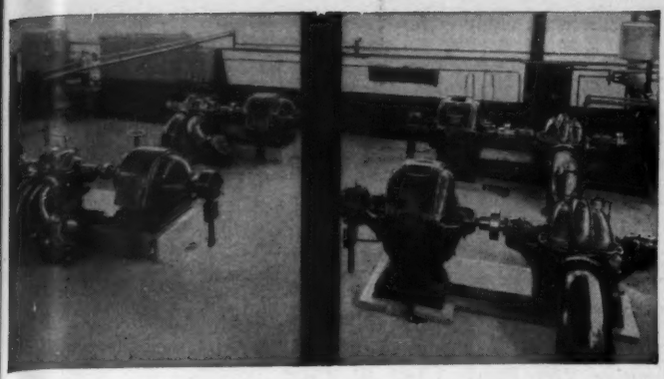
E. S. Calvert, General Superintendent of Devonian Oil Company, operating four natural gasoline plants, has equipped the Kelleyville plant with a Tulsa-Type high pressure fractionator, and is stabilizing all of the plant make. Bubble trays in this fractionator are 12-inches apart, which is in line with the modern trend toward wider spacing of bubble trays. Better efficiencies are secured. E. R. Cox, The Texas Company, in an excellent paper delivered at a recent meeting of the California Natural Gasoline Association offered conclusive evidence of the efficacy of wider spacing of trays. Newer fractionators of this and other types have 14-inch spacing.

Forrest E. Gilmore, formerly of the Forrest E. Gilmore Company, is now located in the Philtower Building with Gilmore Engineering Company and is doing engineering work for two affiliated companies: Airolene Gasoline Corporation, with a plant at Shamrock, Texas, 10,000 gallons capacity, and The Aircraft Gasoline Corporation operating a plant at Little River in the Greater Seminole area. Mr. Gilmore was in attendance at all the convention sessions.

Forrest E. Gilmore Company with headquarters at Portland, Oregon, and Tulsa offices in the Wright Building, was welcomed as a new member of the Natural Gasoline Association of America. The company is carrying out a program of expansion and is also rebuilding some of its plants. Engineering Research and Equipment Company is consultant for the company. The company has established a commercial laboratory for gas and gasoline analysis at 2548 East Admiral Place, Tulsa.

Doctor Walter J. Podbielniak, formerly of Long Beach, was in attendence at the convention. Podielniak moved to Tulsa in May where he will continue consultation. He is also consulting engineer for commercial laboratories established by Forrest E. Gilmore Company. In his discussion of the subject of application of fundamental analysis to absorption tower operation, Podbielniak contributed some interesting and valuable information.

D. E. Buchanan, vice president Chest-



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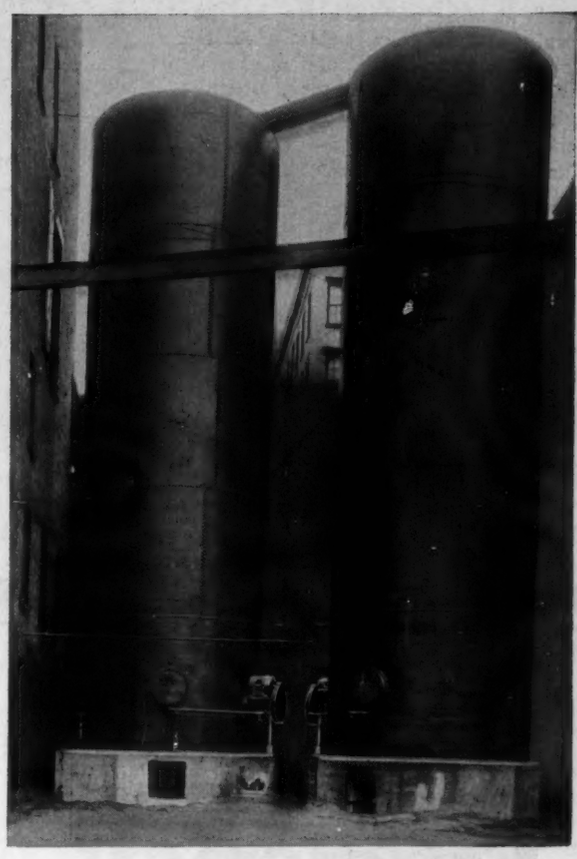

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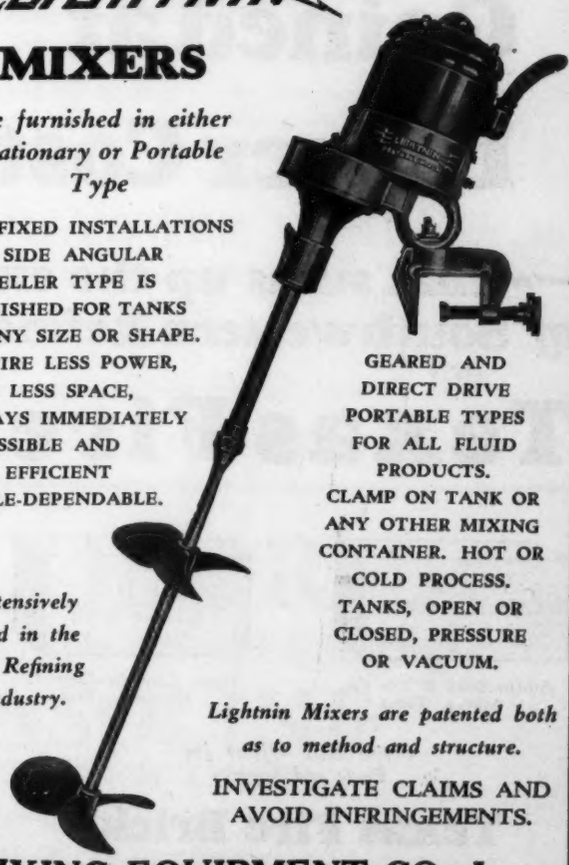

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nut & Smith Corporation, was "ring master" at the smoker given by the Natural Gasoline Supply Men's Association. "Four hundred men in closed paper caps and good humor, boxing matches, girls and boys singing and dancing, and Buchanan as "ring-master", and you have a perfect evenings' entertainment.

Since completion of recent additions to the Norwalk Company's natural gasoline plant in the Santa Fe Springs field, E. L. Tobias states that production of gasoline at this one plant has shown a peak production of 137,000 gallons daily, and is now averaging 115,000 gallons. An article concerning Tobias' Long Beach plant appeared in the March issue of this magazine, and a second article dealing with the operation of the plant will appear in an early issue.

Congratulations to Ray Miller, secretary of the Natural Gasoline Association of America. At his first convention he performed like a veteran. There was a total registration of about 650. There was a marked atmosphere of seriousness of endeavor in cooperative effort. These men mean business.

W. J. Schnur, Executive Vice President, La Salle Petroleum Company, came over for a dutch lunch and a session. He found himself seated on the floor eating with a bunch of oil writers and seemed to enjoy the experience. Schnur says their new gasoline plant at Burkburnett is very economical. The Jenkins cracking unit at the nearby refinery is to be in operation about July 15.

Although he was called upon to prepare a paper on very short notice, not to say the eleventh hour, E. O. Bennett, chief engineer, Marland Oil Company, in his paper, "Repressuring and Its Effect on the Natural Gasoline Industry", made a most valuable contribution to the convention program. His paper evoked much discussion. In regard to his presentation of the possibilities of using depleted oil producing zones for natural gas storage reservoirs as is done at Coalinga and Buena Vista Hills in California, Frank L. Chase, Lone Star Gas Company, aroused interest in his question of the legal rights of a company to do so. Chase speaks in language all can understand. He asked what legal rights are involved when an oil company wants to use a farmer's land as a barn for gas storage. Will the enriched gas bearing more gasoline have to be paid for on a royalty basis, and will that royalty amount to one-eighth of a barrel of gasoline at its price, a barrel of crude oil at its price, or on a natural gas basis. He stated that the question has already come up and makes the legal departments do some tall figuring.

Dr. E. R. Lederer, vice president T. P. Coal & Oil Company, Fort Worth, presided over the more technical session occurring the afternoon of the last day. Lederer is the new president of the association. To Lederer goes credit for putting over an excellent plant operators' meeting at Ranger, Texas, February 26, 1929. Over 300 plant operators were in attendance. D. B. Hiatt, superintendent of gasoline plants at Thurber, Texas for T. P. Coal & Oil Company relates some interesting stories about some old pumps he has in service there that once did their stuff in the coal mines about 1900.

After the reading of a paper by G. M. Davidson, Empire Oil & Refining Company, dealing with gasoline storage practice in the industry, A. J. Schlosser, Barnsdall Oil Company, who was chairman of the session, discussed his intention of storing rectified natural gasoline in an 80,000-barrel steel tank.

R. B. High, Shell Petroleum Corporation, formerly in charge of refinery operations at Shell's New Orleans plant, and who is to be superintendent of Shell's new Houston refinery, stated that for some time past they have been storing natural gasoline in 55,000 and 80,000-barrel tanks at New Orleans without difficulty. This gasoline is stabilized to about two pounds vapor pressure. Losses have been averaging less than one per cent. per month. All

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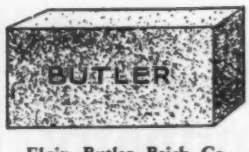

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vapors from these big storage tanks are taken through vapor lines to a gasoline recovery plant on the refinery yard. The customary safety and fire prevention devices are installed.

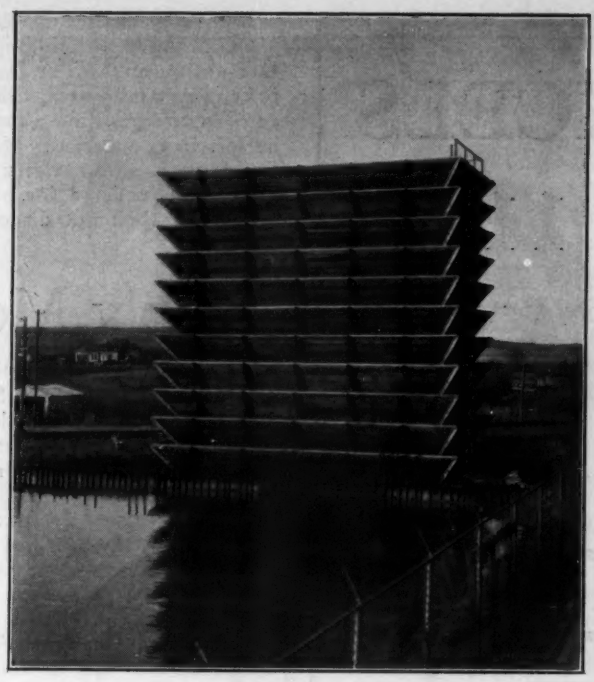
H. A. Trower, Phillips Petroleum Company, who has been president of the association for the past two years, in his opening address at the recent meeting stressed the value of cooperative research and effort. "Much has been done" he said, "that would have been impossible for individual companies. Because much remains to be done I ask for your continued support of the association. Its achievements and aims make it worthy of every natural gasoline manufacturers support. Regardless of the outcome of our present problems it can only be reiterated that varied markets is the chief requisite for our continued prosperity."

In talking about transportation losses of natural gasoline, C. A. Holmes, Skelly Oil Company, Slick, Oklahoma district, told of experience in the old days in which gasoline silghtly wilder than specified would be shipped, to reach destination more stable due to evaporation and handling losses. This practice, because of efficiency of present day fractionating equipment is no longer necessary. He stated that his company was using tank cars of late design which can be gauged and unloaded without opening the car. This type of tank car should prove popular among shippers of natural gasoline.

In further discussion of evaporation or transportation losses D. E. Buchanan, Chestnut & Smith Corporation, stressed the importance of delivering cars to buyers as near full as possible, because the buyer, when he opens a car and finds much outage, immediately begins to think that there must be something wrong with the gasoline or so much of it would not have gotten away. The point was well taken. Regardless of how perfect are the specifications, the receiver is surely dubious of a car with unusual outage.

Following Emby Kaye's paper dealing with fires and fire hazards in the industry, there was much discussion of preventive measures. H. M. Coulson, Sinclair Oil & Gas Company compared conditions of 15 years ago in the Tonkawa and Allewe fields, Oklahoma, when winter time cigarette smoking often took place inside of tightly closed compressor rooms with the present when smoking is not permitted anywhere on the plant yard and compressor rooms are both heated and ventilated. He remarked that his company's policy required that all fire fighting equipment be tested monthly and cards attached to each piece bearing the date and name of inspector and condition.

Further discussion of the fire prevention paper by Emby Kaye, vice president of the association, and head of the



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10—*Simply Thin with Water.* Contains no oil, grease or acid.

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Jersey City New Jersey

Est. 1827

gasoline department of Skelly Oil Company, brought an admonition from R. L. Huntington, also of Skelly Oil Company, Panhandle area, that no two circuits in the gasoline plant should ever be left in connection. He pointed out the dangers where water and gasoline lines are connected for washing of the latter and then not disconnected. No two liquid circuits or gas, air, water, oil or gasoline circuits should at any time be left connected. Mineral seal oil has been known to back-up into the boilers. Water systems have been filled with gasoline. Gas systems have become filled with water. The dangers are apparent.

Supply Men Change Fiscal Year

TULSA.—The constitution of the Natural Gasoline Supply Men's Association was changed at the annual meeting, held here May 23 to make the fiscal year correspond with the calendar year.

This association functions as an auxiliary to the Natural Gasoline Association of America. Its chief activities are the provision of entertainment during the annual convention of the Natural Gasoline Association of America. For the convention in Tulsa May 21, 22 and 23, all entertainment was provided by the supply men. A dutch lunch was provided each day. A smoker the first evening was the high light of entertainment. The second evening was left open and a dance Thursday evening completed the entertainment.

Four directors were elected at the annual meeting. They are M. H. Ketzebue, Tulsa oiler & Machine Company; R. E. Howe, Atlas Supply Company; A. J. Kerr, Pittsburg Equitable Meter Company; and J. B. McMahon, Foxboro Meter Company. These four, with four who held over, and the president of the Natural Gasoline Association of America, complete the board. The officials will be selected from the board.

Membership of the Natural Gasoline Supply Men's Association is composed of American Car & Foundry Company, Atlas Supply Company, Bessemer Gas Engine Company, C. F. Braun & Company, The Bristol Company, C. F. Camp Company, Chaplain Fulton Manufacturing Company, Clark Brothers Company, Continental Supply Company, Continental Tank Car Company, C. & G. Cooper Company, G. M. Davis Regulator Company, Dearborn Chemical Company, B. V. Emery & Company, The Fisher Governor Company, Fort Worth Laboratories, Inc., The Foxboro Company, Goulds Pumps, Inc., Griscom-Russell Company, Hope Engineering & Supply Company, Hurley Brothers, Magneto Ignition Company, The Meriam Company, Metric Metal Works, National Petroleum News, North American Car Corporation, The Oil & Gas Journal, The Petroleum Engineer, Pittsburgh Equitable Meter Company, The Refiner and Natural Gasoline Manufacturer, Refinery Supply Company, M. B. Skinner Company, Smith Separator Company, Southwestern Engineering Corporation, C. J. Tagliabue Manufacturing Company, Tulsa Boiler & Machinery Company, The Victaulic Company of America, Vinson-Canter Company, Westcott & Greis, Inc., Westcott Valve Company, Woobank Pump & Machinery Company, J. A. Campbell Company and Jackson Engineering Company.

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OF TEXAS
Sawyer and Winter Sts.
HOUSTON, TEXAS

Makes this salvage department show a real profit

THE salvage department of one oil concern is allowed twenty-four cents each for cleaning galvanized iron sheets. The major part of this reclaiming work is cleaning. Formerly this was a slow and costly operation—often it proved impossible to get clean surfaces after six hours boiling.

At the suggestion of an Oakite Service Man, this concern moderized their equipment and charged their tanks with a solution of an Oakite material. Now forty sheets at a time are ***cleaned to the metal in two hours.*** The cost, including materials and labor for cleaning, straightening and superintending, has been reduced to eleven and a half cents per sheet. The savings amount to $800 on every batch of 8000.

The successful solution of problems such as this is all in the day's work for the Oakite Service Man near you. Let him go over your cleaning operations with you—you assume no obligation by writing us and asking to have him call.

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Oakite Service Men, cleaning specialists, are located at

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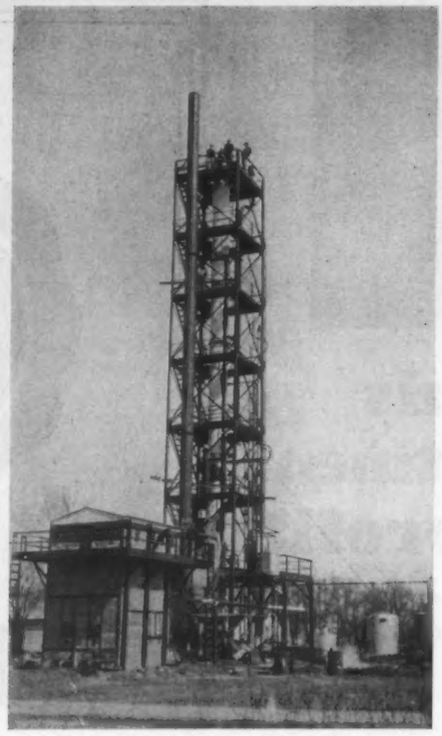
Oklahoma University Has Real Refinery

Construction of a complete refinery unit at the University of Oklahoma, Norman, Oklahoma, is another important step forward by this university in offering courses on the various branches of the petroleum industry. The plant is the only one of its kind built and controlled purposely for use by students at any university.

The new university refinery is not a cracking or topping plant, but really a complete distilling unit of a modern refinery. The unit consists of a combination tube still, vaporizing tower and product tanks. It is capable of running 250 barrels of crude daily. The plant will not be operated more than once a month.

The purpose of the unit is to give students actual experience on a scale large enough that it will offer them a comparison with the work of big plants, and to conduct research experimental work. Heretofore, the only refinery on the campus was an old one-barrel home-made unit.

The old one-barrel plant was not practical from a student standpoint in that it did not give them refinery experience on a large scale. The new plant is expected to give sufficient practical experience to offer a comparison with the larger plants so that it will not be necessary for graduating students to serve terms of apprenticeship.



Experimental plant at Oklahoma University

The plant, valued at $75,000, and made up of the most modern refinery supplies, has been constructed mostly by student labor under the direction of a refinery construction expert at a great saving of expenses.

The products will be the usual run from any commercial plant, gasoline, kerosene, gas oils, various grades of lubricating oils, fuel oil and residue. The residue will amount to about 10 per cent., with the distillate products covering the other 90 per cent.

The four-burner tube still will use gas as its heating power. The tower has 48 bubble refractioning strip plates, with outlet pipes placed at proper levels to carry off the products as they separate themselves from the other products.

The plant will be operated on crude donated from time to time by various Mid-Continent producing companies. After running the crude through the unit, only sufficient of the refined products as required to pay for the cost of operation will be kept by the university. The remainder will be shipped back to the donor of the crude, as refined products, or crude oil, as he may desire. It is expected that the plant will be self-maintaining under this plan.

Indian Territory Illuminating Oil Company and Foster Petroleum Company have agreed to deliver 250 barrels of crude from the discovery well of the Oklahoma City pool. This crude will be used as the first run in the new plant.

Companies desiring a test or analysis of certain oils have been asked to feel free in sending the crude to the university for a distillation test. These experiments will be useful and helpful to both the producing company and the students.

No wax plant will be operated in connection with the distillation unit for some time. Present plans are for the addition of other experimental units later, for the purpose of testing and purifying oils, in efforts to determine under what conditions various grades of oil should be refined to obtain the best refined products.

Doctor Fred M. Padgett, professor of refinery engineering at the University, will be in charge of the plant. Professor Harry C. George, director of the school of petroleum engineering, and whose efforts played a large part in obtaining the gift of the refinery, will be another supervisor of the refinery study.

RICHFIELD HAS NEW CRACKING PROCESS

Richfield Oil Company of California is starting the first unit of a new process for treating cracked gasoline, a process which is designed to effect operating economy through eliminating five working steps in handling cracked distillates. The new process is the invention of Professor Arthur Lachman of the University of California; the rights are held by Richfield Oil Company whose engineers and chemists have been instrumental in bringing it to commercial perfection. Completion of the plant additions is expected to be made within the next two months.

WILCO VALVES

WILCO TANK CONTROL

Scores of installations in the California fields have proven this regulator.

The WILCO TANK CONTROL may be placed on the tank roof if desired, or it may be installed on the ground.

One regulator will operate equally well whether connected to one tank or to a group of tanks.

A WILCO TANK CONTROL will allow all the gasoline laden vapors to pass to the gathering line when gas is being generated and it will allow sufficient Dry gas to enter to prevent a vacuum being formed in the tank when gas volume shrinks.

ATMOSPHERIC pressure may be maintained or the regulator may be set to maintain slight pressure or slight vacuum.

BUILT IN ALL SIZES OF CAST IRON OR STAINLESS STEEL TRIMMED.

SIMPLE-COMPACT-RUGGED
EXTREMELY SENSITIVE

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WILCO VALVES

Refinery and Gasoline Plant Activities

PHILLIPS BUILDING PLANTS

Three new natural gasoline plants and additions to three existing plants, which are now under construction by the Phillips Petroleum Company, already the world's largest manufacturer of natural gasoline, will add approximately 70,000 gallons of gasoline per day to that company's production, according to an announcement made by officials.

The largest of the three plants now being built is known as Gray plant, located in Section 32, Block B-2, H. & G. N. Survey, Gray County, Texas. The plant will operate on well pressure, handle 50 million cubic feet of gas per day and have a daily production of approximately 20,000 gallons. New drilling is supplying more gas than this plant will handle and an additional unit will probably be added in the near future to increase the gas volume handled to 75 million cubic feet and production to 30,000 gallons per day.

Additional drilling about two miles northeast of Phillips Petroleum Company's first Pampa plant in the Bowers pool, Gray County, has produced so much gas that a new plant called Bowers is being constructed in Section 62, Block B-2, Gray County. This unit should be completed about June 15 and is expected to handle 10 million cubic feet of gas through eight compressors and make 15,000 gallons of natural per day.

The third new plant is a 25-million cubic foot well pressure unit to be located in Section 56, Block 25, H. & G. N. survey near Lefors. This plant is expected to make 15,000 gallons per day and will utilize gas now being wasted in this vicinity.

The gasoline production from all three of the above mentioned plants will be tied into the original plant in the Bowers pool where the gasoline will be treated and pumped to loading racks at Pampa. The authorized extensions to existing plants in Hutchinson county will account for about 20,000 gallons additional production. All of the extensions will operate on well pressure.

ABSORPTION PLANT

The American Natural Gasoline & Utilities Corporation of Texas, which was recently organized by E. E. Peacock and associates, is erecting a two-unit absorption process natural gasoline plant rated at 6,000,000 cubic feet daily in the Overall pool, Coleman County. The plant site is located in the northwest corner of Section 19, John H. Barkley survey No. 701. Three Newton absorbers have been shipped in from Santa Maria, California, to be used in this plant. A tank car loading rack has been erected on the G. C. & S. F. Railroad, within a mile of the plant, and the production will be marketed on contract by the Bell Oil & Gas Company, Tulsa. Arrangements have been made for the sale of the residue gas to the Oklahoma Natural Gas Company.

LUBRICATING PLANT

Rio Grande Oil Company will begin construction of a lubricating oil plant at its El Paso, Texas, refinery in the near future. Max B. Miller Company has been commissioned to build the plant. The Company will process its Loving County, Texas, crude through the new plant. This oil is paraffin base crude secured from a depth of 4200 feet with an A. P. I. gravity of 38. J. J. Downey is general superintendent of Rio Grande refineries, with headquarters in Los Angeles. C. F. Witz is superintendent of operations at El Paso.

NEW PANHANDLE REFINERY

H. F. Wilcox Oil & Gas Company, Tulsa, plans construction of a 2000 barrel refinery near Pampa, Texas. The company is now rebuilding its Bristow, Oklahoma, plant, installing a Dubbs cracking unit and modern distillation equipment. The estimated cost of the Pampa plant is placed at $150,000. P. I. Tinkler, formerly with Anderson-Pritchard Corporation at Cyril, Oklahoma, is now general superintendent of refineries for H. F. Wilcox Oil & Gas Company. The company has a large natural gasoline plant operating on sweet gas from the Bowers City pool, southeast of Pampa. The addition of a refinery in this Texas area will provide a close and ready market for the natural gasoline produced in the Bowers City pool.

Golden West Oil Company, Del Rio, Texas, is having preliminary plans prepared for the construction of an oil refinery near Hondo or Devine, Texas. This company also plans a pipe line from the Ina field to the refinery.

FLORIDA GETS REFINERY

Port Everglades Refining Company, Fort Lauderdale, Florida, has awarded contract to Fisher-Williams Corporation, New York, for a 5000 barrel capacity refinery to be erected at Fort Lauderdale. Completion of this plant will add a new refining state to the surveys of the refining industry.

ASPHALT PLANT

City of Freeport, Texas, has acquired the asphalt plant of Freeport Sulphur Company, and plans immediate extensions and improvements to include equipment for the production of asphalt. R. J. Wilkinson, 3701 Delgrado Avenue, New Orleans, is engineer.

PLANT IN NEW FIELD

Foster Petroleum Corporation, Bartlesville, Oklahoma, is operating the first absorption natural gasoline plant in the newly developed Oklahoma City oil field. The plant is located near the discovery well completed some time ago by Indian Territory Illuminating Oil Company. H. V. Foster, president of the Foster Petroleum Corporation, is also president of Indian Territory Illuminating Oil Company. The plant has a rated capacity of 10,000 gallons daily and at present is making around 3000 gallons, which will be increased as the field undergoes development. The field location is north half of Southeast Section 24-11n-3w.

OKLAHOMA BLACK PLANT

Cabot Carbon Company, Boston, Massachusetts, is building a carbon black plant six miles west of Wewoka, Oklahoma. Twelve modern houses for employees are under construction on the half section of land secured as the plant site. Gas gathering lines are being laid into the plant and about 200 men are employed in construction work.

ENGINEER EXAMINATIONS

The Bureau of Mines and the Geological Survey announce being ready to view applications for positions of petroleum engineers and natural gas engineers. Engineers salary is $3800 annually, and associate petroleum engineer and associate natural gas engineering positions will pay $3200. The assistant engineer positions carry a salary of $2600 yearly. Applications must be on file at Washington not later than June 12, 1929.

REFINERY AT DENVER

Midland Oil Refining Company, recently announced plans for the construction of a modern refinery at Denver, to cost around one-half million dollars. According to Logan M. Hines, president of the company, a refinery site will be selected in the near future.

RECONDITONING

The refinery of the Lemont Refining Company, Lemont, Illinois, which was recently purchased by I. A. O'Shaughnessy, is to be reconditioned and its capacity increased from its present rating of 1500 barrels to 5000 barrels daily. The plant will be operated under the name of Globe Oil & Refining Company of which Mr. O'Shaughnessy is president. This company is operating refineries at Blackwell and Cushing, Oklahoma. Crude for the Illinois plant will be secured from the Muskegon field, Michigan. The plant is equipped with a 1500 barrel cracking unit, Donelly process.

THE H-H INHALATOR

A Valuable Resuscitation Device for the Oil and Gas Industries

The H-H Inhalator is a resuscitation device for administering Carbogen (95% of Oxygen and 5% Carbon Dioxide) to those overcome by

Petroleum Vapors
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Smoke, Fumes and Other Causes

When respiration has stopped, artificial respiration by the manual prone pressure method should be employed to start spontaneous breathing. This effort should be assisted by administering Carbogen simultaneously from the H-H Inhalator.

The H-H Inhalator is officially approved by the American Gas Association and is widely used by oil companies at refineries, in the field and on tank ships.

For complete information write for Bulletin No. 80. Demonstrations will be given on request.

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"Everything for Mine and Industrial Safety"

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G. G. Brockway Company
WARREN, PA.

HUMBLE BUILDING PLANT

Humble Oil & Refining Company is starting construction on a skimming plant near the western edge of Boggy Creek, Anderson County, Texas. The initial unit of this plant, which will have a capacity of 5000 barrels, is expected to be completed by about August 1.

Crude run at this refinery will be obtained from Boggy Creek field where Humble Oil & Refining Company controls the entire production, now averaging between 2600 and 3000 barrels. This crude is approximately 38 gravity and yields around 33 per cent. gasoline.

Location of the new plant will be three miles from Neches, or approximately 15 miles northeast of Palestine and 12 miles west of Jacksonville.

Humble Oil & Refining Company has become a large distributor in this northeast Texas territory within the past year, delivering car-lot supplies of gasoline and motor oils to tank wagon distributing points. The construction of the Boggy Creek refinery follows the policy of the company in erecting small refineries at strategic points in its distributing centers.

CENTRAL TEXAS

The Central Texas Refining Company, which maintains headquarters at Corsicana, Texas, is adding to its string of refineries within the state by locating a 2000 barrel capacity skimming plant near Luling and within convenient reach of production in the Salt Flat field. The company has made a two-year contract for crude with the Petroleum Pipe Line Company of Texas, the latter having a gathering system in the Salt Flat field. The above concern has refineries at Brownwood, Corsicana (Angus), and Minerva, Texas, and the latter three were formerly operated as the Kent-Middleton Refining Company. George Mann is general superintendent working under C. A. Middleton, general manager.

Completion of the 1500 barrel capacity Jenkins cracking unit at the Iowa Park Producing & Refining Company's plant, located at Iowa Park, Texas, is scheduled for September 1, according to Peyton F. Gwynn, vice-president and general manager. The company has a 3000 barrel skimming plant in operation. John Beasley is superintendent of this plant.

R. D. Rogers has been appointed manager of Tide Water Oil Company's Bayonne, N. J. refinery, according to a recent announcement by the company. Edward Ellsberg becomes chief engineer. H. S. Chase has been oppointed chief refinery engineer. James J. McGrath, formerly assistant general superintendent at Bayonne, becomes a general superintendent, succeeding R. D. Rogers.

KNOX PROCESS

Fred B. Floyd, president of the Petroleum Conversion Company announces that Shell Petroleum Corporation will erect a large vapor phase cracking unit at its Wood River, Illinois plant of the type made by his company known as the Knox Process. The Wood River plant to be erected for Shell Petroleum Corporation, is to have a capacity of 10,000 barrels daily. Western Oil & Refining Company, operating a skimming and cracking plant near Wilmington, California, will build a second and similar unit in the near future and contracts for equipment have been let to C. F. Braun & Company, Los Angeles. This low pressure vapor phase system operates at 50 pounds.

MICHIGAN REFINERY

J. D. Rather, president of the Amarillo Producing and Refining Company operating refineries at Pyote and Del Rio Texas, announces that his company in cooperation with the Swastika Oil Company will build a refinery at Muskegon, Michigan. The name of the new organization is the Michigan Central Refining Company. Swastika Oil Company is a producting organization in the Michigan field. The new refinery is to have a rated capacity of 3000 barrels.

Stockholders of the Wickett Refining Company and the Bluebonnett Oil Refining Company, affiliated concerns with skimming plants at Wickett, Texas, made contracts during the second week in May to build a 16-mile four-inch line from the above plants to the Shipley pool, located in Southeastern Ward County, Texas, to purchase oil on contract for one year at a price amounting to about 40 cents per barrel below the Mid-Continent postings of Prairie Oil & Gas Company for like gravity oil, such being about 80 cents for the Shipley pool production. A separate company will be formed to build and operate the line, and will include the following: W. B. Hassett, Tulsa; B. L. Woolley, Dallas, Texas; and C. R. Armstrong, Lock Haven, Pennsylvania. O. H. Berryman is manager at Wickett.

Phillips Petroleum Company has placed in operation a five-unit compression process natural gasoline plant rated at two million cubic feet daily in the north extension pool of the Noodle Creek field, Jones County, Texas. This plant is located on the G. M. Sharp farm, and the production is handled via a small pipe line to tank car loading rack at Trent, Texas. The production is averaging about 6,000 gallons daily.

Phillips Petroleum Company's new crude still and cracking unit installed at the company's Borger, Texas, refinery was reported ready for operation June 1. More than 50,000 gallons of cracked gasoline daily is expected to be produced, John H. Kane, executive vice president, has announced. The whole plant now has a capacity of 10,000 barrels of crude daily.

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ACCURATE TEMPERATURES

"I am the SARCO TEMPERATURE REGULATOR. I guard the temperature in thousands of manufacturing plants. I never sleep, never get tired and never call for time off. I never make mistakes because I am completely automatic. I usually pay for myself in a short time by the saving in labor and by eliminating spoiled goods. I cost little to buy and take little time to install. As I am entirely self-contained, I don't need compressed air, water pressure or electricity to make me operate. I have very few parts, with nothing to get out of order—so I stay on the job indefinitely without repair bills."

This is the SARCO story in a nut shell—the Temperature Regulator that has proved its value in every plant in which it has been installed.

Why not let SARCO prove its value to you? We will be glad to send it on a 30-day FREE trial. Test it any way you wish, and if it doesn't prove its case, return it and don't pay one cent.

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BOSTON BUFFALO CHICAGO CLEVELAND DETROIT PHILADELPHIA PITTSBURGH ST. LOUIS
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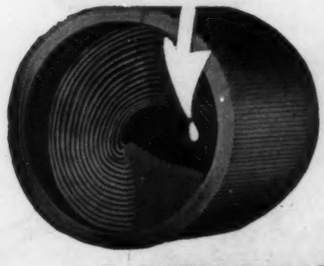
SARCO Temperature Regulator

The Spiral Motion Is the Trick



That's why Hood's Chemico Spiral Packing Rings have been selected by so many engineers. The center hole prevents choking and clogging.

Made of acid-resisting shale—practically indestructible.

Used by all big producers because of the intensive movements.

Samples on request

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For cracking process in oil refineries we furnish Aluminum Armored Asbestos filled Gaskets and Corrugated Armco Iron or Monel Metal Asbestos encased.

Copper rings 3/16" thick for 4 and 5" O. D. tubing.

Washers or gaskets made of Aluminum, Copper and other Metals.

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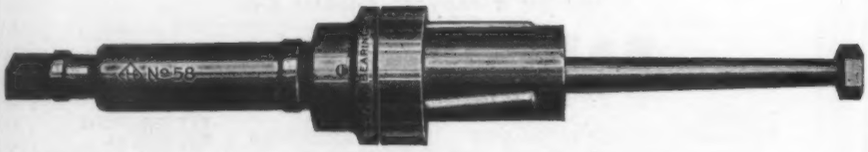
NEW BRUNSWICK, N. J.

Heavy Duty Expanders for Still Tubes



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Hydraulic Jacks
Hydraulic Punches

A. L. HENDERER'S SONS

Wilmington, Del.

Established 1870
Expanders since 1884

Paul M. Raigorodsky, one of the organizers of Engineering Research Equipment Company has disposed of his interests in that company and has announced his resignation as its secretary and treasurer effective June 3, 1929. Mr. Raigorodsky and Dr. Walter J. Podbielniak have become associated as consulting engineers and will maintain offices in Tulsa.

R. H. Rowland, sales manager of the Bolene Refining Company, Enid, Oklahoma, has announced the appointment of A. C. Cooley as sales representative in Minnesota with headquarters at the Antlers Hotel, Minneapolis.

P. G. Maranville, assistant superintendent of the Bolene Refining Company, Enid, Oklahoma, recently returned from New York, where he transacted business for the company.

H. F. Allspaugh, purchasing agent for the McIlroy Oil Company and Dixon Creek Oil Company, pioneer producers in the Texas Panhandle district with headquarters at Amarillo, has resigned to become associated with the Western Supply Company at Pampa, Texas.

W. G. Ricketts, general superintendent of production for the Amerada Petroleum Corporation with offices at Tulsa, visited the Fort Worth district offices of the company late last week while enroute to West Texas and New Mexico fields for a vacation in California. He is making the trip by auto, and is accompanied by members of his family.

W. W. McIlroy, president of the McIlroy Oil Company and vice-president of the Dixon Creek Oil Company, which have general offices at Amarillo, Texas, was a business visitor in Dallas late last week. McIlroy shares the general feeling of optimism that has gripped the Panhandle operators since the recent crude price advance, and uncovering of flush oil areas in Gray County.

The Land Supply Company, Oklahoma City, which has been a distributor of A. Y. McDonald Manufacturing Company, Dubuque, Iowa, products, has opened a supply store in Tulsa, at 307 East Third Street. With this expansion the oil handling equipment of A. Y. McDonald Company will be available for immediate delivery to Tulsa customers. The Oklahoma City store of the Land Supply Company is located at 516 North Broadway.

C. F. Braun & Company, Alhambra, California, opened a sales and engineering office at San Francisco in the Russ Building, 235 Montgomery Street, President Carl F. Braum announced recently. This office is in charge of Milton H. Roths as manager. Connected with the office are trained industrial engineers who are prepared to make surveys and to submit quotations on the Braun products.

NEW EQUIPMENT, CATALOGS, BULLETINS, BOOKS

Testing a 1000-pound pressure manometer under 3000-pound pressure

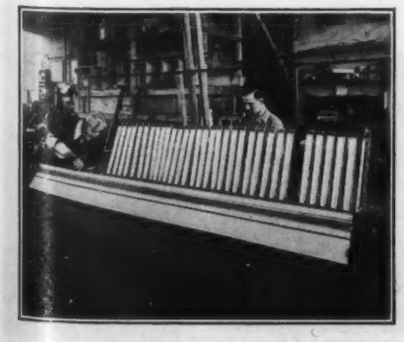
U-Tube Manometer

MERIAM COMPANY

The latest type of U-tube manometer manufactured by the Meriam Company, West 112 Street, Cleveland, contains several details which have been designed to give increased reliability and ease in maintenance.

The glass tubes, as described by Mr. Beckett of the Meriam Company, are made from specially tough glass, having unusually thick walls. This glass is made to exact specifications and ordered in lots of several tons to insure the quality of the material and the thickness of the walls being uniform. This, combined with the special system of packing for shipment, minimizes the risk of breakage when in use or in transit—a matter of great importance in the case of portable instruments.

Two methods of rendering the manometer leak-proof are used. For instruments designed for use up to a maximum pressure of 300 pounds the frame of the manometer contains two threaded recessed faced holes for receiving the two ends of the glass U-tube. Into the recessed facings are placed hard and soft washers—the hard washer to take up the thrust of the gland and the soft washer to expand tightly around the outside of the tube.



Assembling a 100-inch U-Tube manometer. The 15-inch size is shown here

For the manometers designed for operating on pressures up to 1000 pounds, extra provisions are made to prevent leakage and safeguard the U-end of the tube from fracture under the strain of the pressure.

A steel gland is threaded into the aluminum manometer frame, and over this, on the inner side of the frame, the steel packing nut is screwed tightly down. The packing between the two is thus compressed sufficiently to withstand the heavy pressure tending to force the glass tube out of the gland. As an additional safeguard, the U-end of the tube is embedded in cement to prevent movement and to take up the spreading stress.

NEILAN, SCHUMACHER & CO. ISSUE CATALOG

The 1929 catalog of Neilan, Schumacher & Company, Los Angeles, has just been published. It carries a full line of sensitive automatic control equipment for the oil and gas industry. The catalog contains many of the latest developments in advance regulating equipment. For further information write the company at 647 Santa Fe Avenue, Los Angeles.

STEAM JET EJECTORS

The Elliott Company of Jeanette, Pennsylvania, has issued Bulletin "G-1" on Steam Jet Ejectors. It is a 24-page publication, profusely illustrated. It describes the complete line of ejectors as made by Elliott Company for application to all kinds of service, more particularly the application for industrial process work involving the use of vacuum. Typical applications of ejectors to processes such as petroleum refining and deodorizing are illustrated and described. The various types of Elliott ejectors in single-stage, two-stage, three-stage and special types are fully covered.

Copies may be had from Elliott Company at Jeanette, or any of The Elliott Company district offices in principal cities.

Rubshell Texas, Inc., has been formed with headquarters in the Post-Dispatch building, Houston, to deal with the local demand for the line of Rubshell paints originally developed by A. C. Holzapfel, president of the International Compositions Company.

G. L. Holzapfel, whose experience as research engineer with some of the largest oil companies has covered a number of years, is vice-president of the company and is in charge of the Houston office.

Centrifugal Acid Pumps

U. S. STONEWARE COMPANY

The U. S. Stoneware Company, 50 Church Street, New York City, is making a line of centrifugal pumps (chemical stoneware lined) designed along hydraulic lines.

An outstanding feature of the chemical stoneware lined pumps is that they are declared to be incorrodible. The casing, impeller and all parts coming in contact with the liquid are built of acid-proof chemical stoneware. The pumps are recommended for the handling of all acids, alkalies, chemicals and corrosive solutions, weak or strong, with the exception of hydrofluoric acid.

The metal bushing is protected and sealed against contact with the fluid handled, by the shaft sleeve and stoneware nut threaded on the outer end of the shaft. A patent application is pending on this feature, because the principle involved represents a very considerable improvement in design. The shaft is of high grade open hearth steel, machined all over and is fully protected with chemical stoneware inside the pump.

Complete ball bearing equipment is furnished, consisting of extra heavy, deep-groove ball bearings, mounted in a dirt and dust proof bearing housing. There is provision for grease lubrication as well as for Alemite grease gun connections. The bearing unit consists of one held bearing which maintains the rotor in positive position and prevents lateral movement, absorbing at the same time, any lateral thrust of the rotor. The second bearing floats and allows for expansion and contraction of the rotor due to change of temperature.

The chemical stoneware casing is made with accurately ground joints and is supported in bored seats in the metal housing. This housing is made of heavy cast iron, is of the horizontally split type, and supports and protects the chemical stoneware lining.

The casing is provided with a large stuffing box having space for a generous supply of packing. The packing is a specially-prepared acid-proof asbestos.

The pump is made with a rugged cast iron base with space and flexible coupling for mounting motor in case of direct connected units or with pulley for belt driven outfits.

A chemical stoneware priming cock is provided for the pump discharge. This is a very substantially constructed valve, protected with armor plates. It is fitted with metal rigging for holding and rotating the plug. The pump inlet is provided with a chemical stoneware 90 degree elbow. Cast iron clamps

and bolts are furnished for attaching the elbow and priming cock to the pump.

Each pump is hydrostatically tested and given a complete operating test before shipment.

HEAT TRANSFER APPARATUS

Griscom-Russell Company, 285 Madison Avenue, New York City, has a new 36-Page bulletin on Shell-and-Tube heat transfer apparatus. The type of Griscom-Russell shell-and-tube subcooling and partial condensers, heat exchangers, coolers and heaters and their applications in refineries and natural gasoline plants are concisely described as to method of operation and construction.

Among the interesting features of this bulletin is a very complete tabulation of condensing, cooling, heating and other heat transfer processes in the typical refinery or gasoline plant, with a list of Griscom-Russell apparatus adapted to each process. There is a series of diagrams showing the construction of the different types and a number of charts and tables, collected from practical sources or made up by the engineering department of the company.

Copies may be had by writing the above address for Bulletin No. 1651.

CELITE FOR CONCRETE

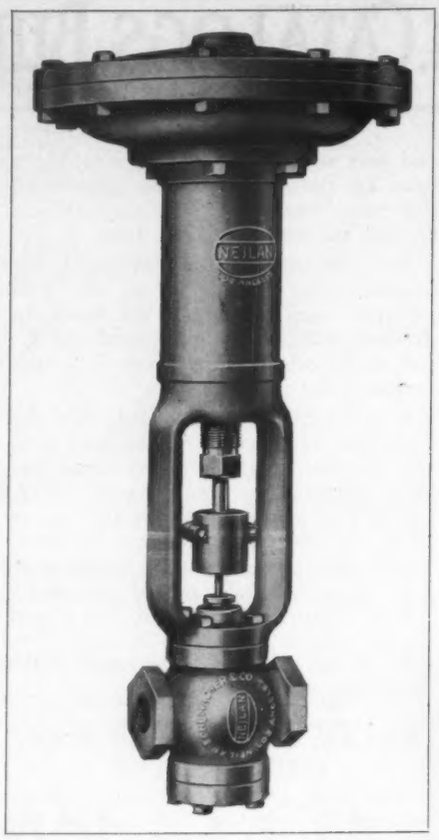
Johns-Manville Corporation, 292 Madison Avenue at 41st Street, New York City, is mailing out copies of its new 24-page illustrated circular entitled "Celite for Concrete," a new announcement just off the press.

Celite is a product recently added to the Johns-Manville line. The circular carries specifications covering the use of the new product in concrete, describes the product and explains how it is used. Photographic illustrations of structures, including tanks, bridges and office buildings, tunnels and vaults, in which the product was used, are used throughout the booklet.

The corporation will gladly furnish interested persons with a copy of this booklet upon request to the above address.

CAMPBELL AGENCIES

Campbell Engineering Company, 1060 Broad Street, Newark, New Jersey, announces the following agency appointments: George B. Allan & Company, 405 North Texas Building, Dallas; L. E. Pollard, Oliver Building, Pittsburgh; W. R. Simpson, Williard Hotel, Tulsa, and W. B. Tardy, 74 Knickerbocker Building, Baltimore. These agencies will distribute for Campbell Engineering Company the Campbell recording and indicating steam flow controller for oil stills, the "Tar Baby" fuel burner, fluid level control and relief devices, and power specialties.



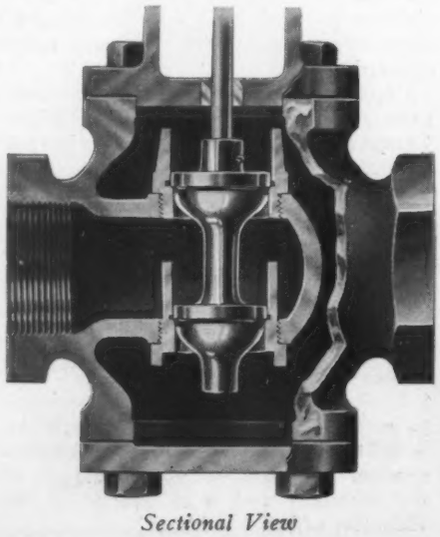
Ball Bearing Motor Valve

Ball Bearing Motor Valve

NEILAN, SCHUMACHER & COMPANY

A new sensitive motor valve for use with temperature and flow controllers has been recently put on the market by Neilan, Schumacher & Company. These valves are made with ball bearing guides to eliminate friction. The ball bearing construction gives a full floating action which enables the motor valves to draw excellent charts.

A sectional drawing shows the appllication of ball bearings which are made of stainless steel as are the valve stems and stuffing boxes. This also indicates the large, flexible, multiple springs which, coupled with the large sensitive diaphragm, provide greater power for operating the motor valve.



Sectional View

Part of the success of these valves is due to the patented Neilan parabolic gradual opening valve which feature is used on most Neilan motor valves. This parabolic valve is the result of many months of research by Neilan engineers and designers. It provides a graduated port opening. The valve is called parabolic because its flow curve reproduces a parabola, a perfect flow curve.

For advertising reasons as well as to avoid imitation, Neilan motor valves are painted a brilliant crimson. Additional information in the form of a colored bulletin may be had from the company, Los Angeles.

Harbison - Walker Elects New Vice-Presidents .

RAYMOND WILLEY

KENNETH SEAVER

Kenneth Seaver and Raymond Willey were elected vice presidents of the Harbison-Walker Refractories Company, Pittsburgh, at a meeting of the board of directors April 15. At this meeting G. G. Coolidge was appointed assistant to the president, J. E. Lewis, and W. B. Coullie was appointed general sales manager, succeeding Mr. Seaver.

Mr. Seaver, a graduate of the Massachusetts Institute of Technology, has been with the company 27 years. His election to the vice presidency was preceded by long terms as chief engineer and general sales manager.

Mr. Willey has been identified with the manufacture of refractories since 1902, serving as superintendent of Harbison-Walker plants, district superintendent and works manager. He has

W. B. COULLIE

G. G. COOLIDGE

FORGED STEEL PRODUCTS

HIGH GRADE LINES QUICK SERVICE

VALVES	FLANGES
ELLS	BUSHINGS
TEES	COUPLINGS
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Also

ATWOOD GATE VALVES
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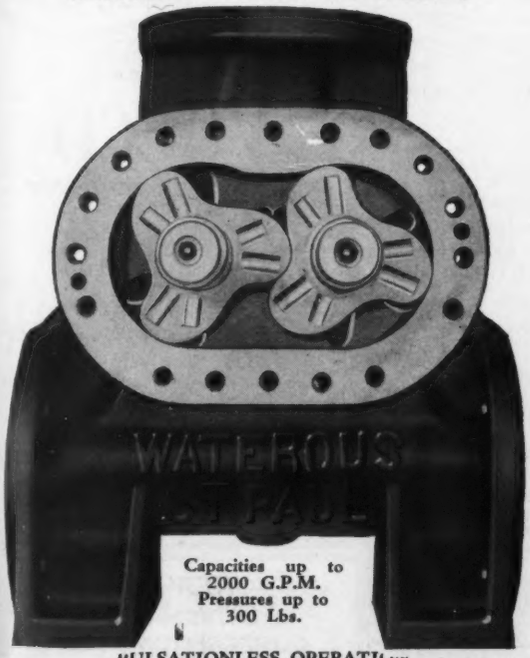
HOUSTON, TEXAS

WATEROUS ROTARY PUMPS



Capacities up to 2000 G.P.M. Pressures up to 300 Lbs.

PULSATIONLESS OPERATION

The rotor of the Waterous pump is the result of forty-five years of rotary pump manufacture. The characteristics of the unique shape of the rotors shown above are high efficiency and pulsationless operation. Rounded curves instead of sharp corners eliminate cavitation, knocking and pulsation. When you are considering the purchase of rotary pumps, investigate the Waterous. Agents in principal cities.

Waterous Dependable

WATEROUS COMPANY

SAINT PAUL MINNESOTA

Latite alone has *all* of these high-temperature-cement qualities

(1) Excellent working properties.

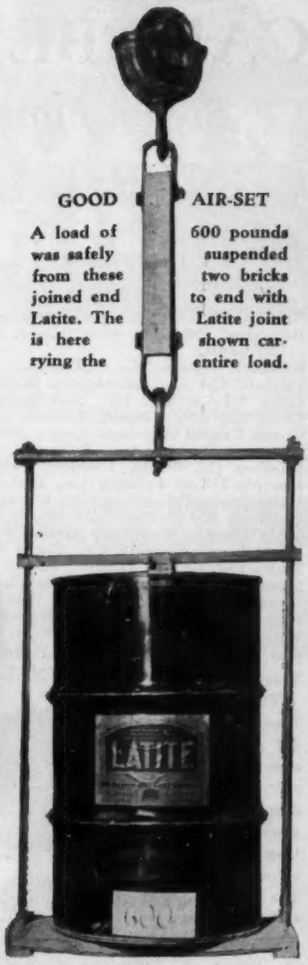
(2) Good air set.

(3) Strength under heat.

(4) High refractoriness.

That's why Latite gives matchless results in refinery service. Use it for: Laying fire-brick in stills and boiler settings: Making monolithic baffles and patches: Coating furnace walls, etc.

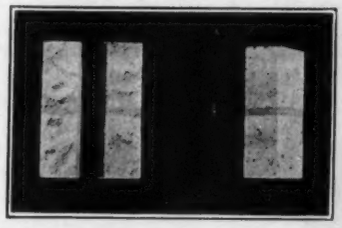
EXCELLENT WORKING PROPERTIES



GOOD AIR-SET

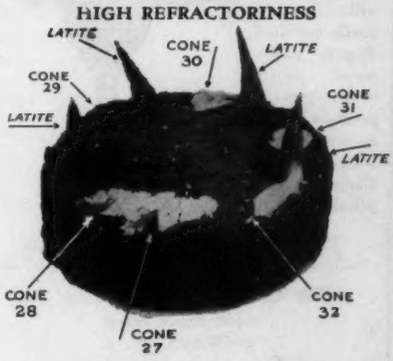
A load of 600 pounds was safely suspended from these two bricks joined end to end with Latite joint Latite. The joint is here shown carrying the entire load.

STRENGTH UNDER HEAT



The bricks shown above were bonded with a thick 3/8" Latite joint and placed under a load of 25 lbs. per square inch in a furnace heated to 2462° F. The Latite joint did not deform in the least. Ordinary cements became soft in this test and were squeezed from the joint This is the standard A.S.T.M. test used for determining load-bearing properties of fire brick.

HIGH REFRACTORINESS



These cones were heated in a gas furnace at increasing temperatures until standard pyrometric cones Nos. 27, 28, 29, 30, 31, and even 32 (3218 deg. F.) had melted. The four Latite cones were left standing as pictured, showing that this remarkable cement has a softening temperature over 3200 deg. F by actual A. S. T. M. cone test.

Branch Offices and Representatives

NEW YORK
SAN FRANCISCO
LOS ANGELES
EL PASO
SALT LAKE CITY
HOUSTON
WICHITA FALLS
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PHOENIX
SANTA FE
RENO

The Denver Fire Clay Company

DENVER DFC COLORADO

Salt Lake City El Paso New York City

Partial List of American Refiners

who have been supplied with the

CAMPBELL

Steam Flow CONTROLLER *for* OIL STILLS

Ashland Refining Company, Ashland, Ky.
Associated Oil Co., Avon, Contra Costa Co., California.
Barnsdall Refining Co., Okmulgee, Oklahoma.
Canfield Oil Co., Coraopolis, Penn.
Cities Service Ref. Co., East Braintree, Mass.
Craig Oil Co., Toledo, Ohio.
Crown Central Petroleum Corp., Houston, Tex.
Emlenton Refining Co., Emlenton, Penn.
Freedom Oil Works, Freedom, Penn.
Humble Oil & Refining Co., Baytown, Texas.
Independent Oil & Gas Co., Okmulgee, Okla.
Louisiana Oil Refining Co., Shreveport, La.
Mid-Continent Petroleum Corp., Tulsa, Okla.
Pennsylvania Refining Co., Karns City, Penn.
Skelly Oil Co., El Dorado, Kansas
Standard Oil Co. of N. J., Baltimore, Md.
Standard Oil Co. of N. J., Baytown, Texas
Standard Oil Co. of N. J., Bayway, N. J.
Standard Oil Co. of N. J., Jersey City, N. J.
Sun Oil Co., Marcus Hook, Penn.
Tidewater Oil Co., Bayonne, N. J.

The Watermelon Type is shown at the right. This design takes care of two delivery points, simultaneously and proportionately. Campbell Controllers record or indicate in pounds of steam per hour. The flow rate is varied at will. Rugged. Easily installed. Readily understood. Wherever there is pressure drop in any process work the Campbell is applicable.

FILL IN, TEAR OFF, AND MAIL

The Campbell Engineering Co.
1060 Broad Street,
NEWARK, N. J.

Manufacturers of the TAR BABY BURNER, to handle Fuel Oils, Water Gas Tar, Acid Sludge, and Residue Fuels.

Without obligating us in any way, please send information on ( ) the Watermelon Type of Control, ( ) the Pumpkin Seed Type, ( ) the Tar Baby Oil Burner.

Name.....

Firm.....

Street.....

City.....State.....

been assistant to the vice president in 1916.

Mr. Coolidge, a graduate of Yale scientific school in 1904, joined the sales department of the company shortly thereafter and in 1913 was made district sales manager at Pittsburgh. In 1923 he became assistant general sales manager.

W. B. Couille joined the company in 1906 as a clerk. Advances during 21 years brought him to the position of assistant sales manager in 1927.

Directors re-elected April 15 are H. W. Croft, Joseph Dilworth, O. M. Reif, J. E. Lewis, Ralph W. Harbison, Nin McQuillon, J. St. C. Brooks, Jr., Arthur E. Braun, Raymond Willey, Kenneth Seaver, Richard K. Mellon, J. E. MacCloskey, Jr., J. B. Cullum, John F. Fletcher and B. A. Clements. The following officers were elected by directors April 16: H. W. Croft, chairman of the board; J. E. Lewis, president; O. M. Reif, Nin McQuillon, Kenneth Seaver and Raymond Willey, vice presidents; P. R. Hilleman, secretary; and W. Forman Bickel, treasurer.

Briggs & Turivas, Inc., Blue Island (Chicago), Illinois, have recently purchased the by-product coke plant of Mayville Iron Company, Mayville, Wisconsin, where 108 ovens have been operated with a coking capacity of 1500 tons of coal daily. This plant, which has been inactive for several years, was fully equipped for manufacturing tar, ammonia, naphtha, benzol, motor oils and toluol. The new owners are now working over the old plant to resume operations, junking worn equipment and salvaging considerable modern equipment which was installed within the past 10 years but used only slightly.

FIRE PROTECTION

"Fire Protection," a 24-page booklet just issued by the Chicago Bridge & Iron Works, deals with fire protection at industrial plants, clubs, institutions and schools, and describes the various methods and equipment used in providing a private system. The booklet is well illustrated and in addition to tables giving the standard capacities and sizes of Horten tanks it includes hydraulic tables for calculating water pressures, friction losses, pipe sizes for fire streams, etc.

Copies of the booklet will be sent by the Chicago Bridge & Iron Works on request.

B. P. Leintz & Company has its new annual catalog describing installations of its Recirculating Systems and Oil Burning Equipment ready for distribution. The brochure carries a number of photographs of Leintz installations in the refining industry and much interesting descriptive matter regarding efficiences and methods of installing this equipment. Copies of this catalog will be furnished to those interested by the company at Kansas City, Missouri.

Rubshell

FOR

Inside of Tanks

WITHSTANDS

H_2S & H_2SO_4

and other corrosives met with in Refineries

THE ONLY PAINT TRIED, TESTED and USED EXTENSIVELY by the PRINCIPAL COMPANIES

Also for condensers, agitators, kettles, exchangers, etc.

STOP THAT CORROSION TO-DAY!

VOLCO

HOLZAPFEL'S HEATPROOF PROTECTIVE

WITHSTANDS

RED HEAT!

Use it on any surface too hot for other paints

Extensively used for hot smoke stacks, exhaust pipes, mufflers, etc.

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